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NOTES ON FISHES IN THE ZOÖLOGICAL MUSEUM OF STANFORD UNIVERSITY, VII

NEW AND RARE PHILIPPINE GOBIES FROM THE HERRE 1936–1937 ORIENTAL EXPEDITION, AND IN THE COLLECTIONS OF THE BUREAU OF SCIENCE

By ALBERT W. C. T. HERRE
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SIX PLATES

I was able to spend most of December, 1936, and half of January, 1937, in the Philippines. At Nasugbu, Batangas Province, facing the China Sea, a number of surprising novelties were obtained during this trip, as well as several little-known species of fishes. At Dumaguete, Oriental Negros Province, as usual, more new fishes were collected, and from various parts of the Islands other new or rare species were secured. A marked feature was the high proportion of imperfectly known or new gobies obtained. In addition, the unnamed gobies in the collection of the Division of Fisheries of the Department of Agriculture and Commerce were studied, and revealed very interesting or unknown species. Five species believed to be new are here presented, together with annotations upon several others notable for their apparent rarity.

Nasugbu faces the open China Sea, and the collections obtained there within a few hours show that similar intensive collecting almost anywhere along the Philippine coast of the China Sea would richly repay students of fishes. The coasts of Zambales, Pangasinan, and the Ilokos Provinces, and Mindoro, Palawan, and Balabac Provinces all offer great possibilities.

Careful exploration of their shores will add greatly to the fish fauna of the Philippines.

The drawings are the work of the outstanding Philippine fish artist, Mr. Pablo Bravo.

GOBIUS ELMERI sp. nov. Plate 1.

Dorsals VI, I, 8; anal I, 7; scales in longitudinal series 36 plus 2 on caudal base; in transverse series 11; predorsal scales 4, very small.

Body slender, with nearly parallel dorsal and ventral profiles, depth 6 times in length. Head broader than deep, length 3.3 in standard length; rounded caudal equaling head.

Dorsolateral eyes very close together, 3.4 times in head, interorbital space a mere line, about 20 times in eye diameter; blunt, short snout 4.25 in head; mouth nearly horizontal, maxillary reaching a vertical from front margin of pupil, 2.8 in head; upper jaw with an outer row of enlarged teeth, 3 rows of very small teeth behind; lower jaw with a similar arrangement, outer teeth only half the size of outer row above.

Low first dorsal scarcely reaching second dorsal origin when depressed, 12.8 in head; second dorsal and anal not reaching caudal base when depressed, fins equal, highest posteriorly, 2.25 times in head; broadly rounded pectoral equal to head; upper rays characteristic of genus, free and silky; broad ventrals reaching anus, 4.3 times in length, 1.3 in head; least depth of caudal peduncle 1.8 times in own length.

In alcohol dark brown, with traces of 4 crossbands over back, first predorsal, second under first dorsal, the other two under second dorsal; along side, from pectoral axil to caudal, a row of 8 nearly circular black spots; first dorsal with a dark-brown crossband; second dorsal, anal, and caudal dark brown; pectoral and ventral light brown, pectoral with a large blackish bar on base.

Described from the type and only specimen, 28 mm long, taken from a tide pool at Nasugbu, Batangas Province, Luzon.

I take pleasure in naming this species after my fellow student and friend of many years standing, Mr. A. D. E. Elmer, distinguished for his work in Philippine botany.

VAIMOSA CARDONENSIS sp. nov. Plate 2.

Dorsals VI, I, 7; anal I, 6 or 7; scales in lateral series, 24 plus 1 or 2, rarely 23 plus 2; scales in transverse series, 9; predorsals 9 in males, usually only 7 in females; two anterior scales enlarged, last scale partly between hind portion of eyes.

In mature males depth 3.8 to 4.2, head 2.8 to 3.1, caudal 3.8 to 4 times in length; eye 3.75 to 4, snout 4.8 to 6, height of first dorsal 2.4 to 2.5 times in head; second dorsal and anal of same height, 2 to 2.1 in head, pectoral 1.2 to 1.4, ventral 1.5 times in head. Mouth very large, maxillary in old males reaching angle of preopercle, then 1.2 times in head; least depth of caudal peduncle 1.8 in head, 1.3 times in its own length.

In gravid females depth 3.4 to 3.8, head 3.2 to 3.6, caudal 3.4 to 4 times in length; eye 3.33 to 3.6, snout 5 to 5.5, first dorsal height 2.5 times in head; second dorsal and anal usually of same height, rarely anal a little higher, 1.66 to 2 times in head; pectoral 1 to 1.25, ventral 1.25 times in head; mouth small, maxillary sometimes extending to a vertical from middle of eye, 3.1 to 3.33 times in head.

Body relatively stout and deep, arched back curving to boldly convex snout; eyes flush with profile or projecting above it, very close together, interorbital very narrow, usually but a line; in males head large, thick and heavy, wider than deep, breadth equal to distance from middle of eye to posterior end of head. Vertical fins low, first dorsal rarely reaching origin of second dorsal when depressed; the somewhat pointed pectoral elongate; the small ventrals not reaching anus in females, sometimes reaching anus in males.

In alcohol pale yellow, scales of upper half more or less tinged with pale brown or with pale-brown margins; some specimens show traces of 4 or 5 dorsal crossbands and 4 spots along middle of side; upper part of eye heavily pigmented, blue-black; first dorsal with a brown band basally, usually poorly defined; second dorsal with 2 or 3 brown crossbands; caudal with 3 irregular brown crossbands; anal dusky, ventral clear to dusky; pectorals clear.

The type is a male, 21 mm long. Described from 35 specimens, 14 to 21 mm long. Ten of the specimens are males and the rest are females, nearly all in breeding condition. Females 15 mm long are full of eggs. The specimens came from Cardona, a town on the north coast of Laguna de Bay, Luzon. The collector failed to state whether they were taken from a stream or from the lake itself, but they probably came from the latter.

VAIMOSA FUSCA Herre sp. nov. Plate 3.

Dorsals VI, I, 7; anal I, 7; 30 scales in a lateral series, first two much smaller than the rest, plus 3 on caudal base; 10 scales

from second dorsal origin to anal origin, and 10 predorsal, anterior scale very large, extending to interorbital; 16 scales on opercle.

Depth 4.25, broad, rounded caudal 3.75, head 3 times in length; eyes large, close together, dorsal, in anterior half of head, extending above dorsal profile, 3.33 times in head. The bluntly rounded, very short snout two-thirds of eye, 5 times in head; postorbital longer than eye and snout together, 1.9 in head; interorbital 1.75 times in eye.

Dorsal profile horizontal, ventral profile arched from chin to caudal base, posterior half of body strongly compressed, head broader than trunk, its width equal to greatest depth or 1.4 times in length of head. Mouth oblique, small, jaws equal, maxillary extending to a vertical from anterior part of eye in type, somewhat larger in paratypes. Teeth minute, in 3 rows in both jaws. A row of sensory papillæ beginning before middle of eye and running down to and across middle of preopercle; between it and eye a second, much shorter row.

Dorsals close together, first dorsal damaged but its height 8 times in length, 2.625 in head; in male specimens second spine greatly elongate, 2.5 times in length; last second dorsal ray longest, falling far short of caudal when depressed, 6.4 times in length, 2.1 in head; last anal ray longest, not reaching caudal, 5.33 times in length, 1.75 in head; pectoral pointed, 3.76 times in length, 1.24 in head; broad ventral 4.57 times in length, not reaching anus by 2 scales; least depth of caudal peduncle 1.6 times in own length, 2.1 in head.

In life blackish brown, a few black crossbands on posterior part dimly visible posteriorly, masked by general dark color. Two conspicuous circular black spots on caudal base; first dorsal with 2 basal black spots and a median brown crossbar, expanding into a large black spot between third and last spines; second dorsal dusky, with blackish-brown spots on membranes; anal very dark, with 2 blackish-brown spots beneath it and a cross-row of large blackish-brown spots along middle; light-brown caudal crossbarred by rows of blackish-brown spots on rays; pectorals clear, ventral dusky. In alcohol little different, dark brown all over, top of head blackish, each scale with a blackish-brown basal spot.

The type is a female, 32 mm long, not in breeding condition, taken from a tide pool at Dumaguete, Oriental Negros Province, in December, 1936. The anal papilla is thick, rounded at the tip, and rather short.

Fusca, dusky.

A male paratype, 24 mm long, taken from a mangrove swamp on Singapore Island, presents several differences, but undoubtedly belongs here. Dorsals VI, I, 7; anal I, 6; scales 28 in lateral series, plus 2 on caudal base, 9 in transverse series; predorsal scales 10, opercular scales 16. Depth 4.3, head 3.6, caudal 4 times in length. Eye 3.5, snout 4.46 times in head; interorbital a little broader than eye.

In the male the color pattern in alcohol is not marked by dusky brown, as in the female. A series of 5 blackish-brown crossbands over the back merges with a series of dusky elongate spots along the side, forming a series of stripes running diagonally downward and forward; all the scales are more or less brown, except on the throat and abdomen; two circular black spots on the base of the caudal, as in the type, the upper one the larger; the first dorsal is black on the basal half, with a broad white bar above, and a black margin; the second dorsal has 2 crossbands of black spots; the caudal has many crossrows of fine black dots; the anal is dusky with a white margin, the other fins clear.

Fifteen paratypes from Dumaguete range from 12.5 to 29 mm in length, and agree in the main with the Singapore specimen; preopercular scales 14 to 16; in lateral series 26 to 30; predorsal, 10 to 12. The maxillary does not exceed a vertical from the rear edge of the pupil. Depth 3.5 to 4 in length. Their color varies from very pale to very dark brown. All have the 2 conspicuous circular spots on the caudal base and all have 5 to 7 black stripes over the back and down the side to or nearly to the abdomen, giving it more or less of a brindled appearance and making it very conspicuous when mixed with other *Vaimosa* species. The first stripe is over the nape and descends diagonally behind the pectoral base; the second runs down from the large black spot on the first dorsal and is inclined forward; two descend from the second dorsal and two are on the caudal peduncle; sometimes one is missing or an extra one is interpolated; they may be vertical, inclined forward, or angulate with the angle forward.

BRACHYGOBIUS AGGREGATUS sp. nov. Plate 4.

Dorsals VI, I, 6; anal I, 6; scales in lateral series 22 or 21 (rarely 23), plus 1, 2, or even 3 on caudal base; transverse series 7 or 8; no predorsal scales.

Thick, robust, back slightly convex, head large, bluntly rounded, short snout nearly vertical.

Females have the depth 2.8 to 3, head and caudal 2.7 to 3 times in length; head much wider than deep, length equal or nearly equal to body depth, breadth 1.1 to 1.2 in length; eye in first half of head flush with profile or slightly projecting, 3.5 to 3.7, snout 4.5 to 4.8, postorbital twice in head; interorbital equaling eye. Mouth very oblique, with projecting, heavy lower jaw, maxillary equal to eye and reaching beneath front part of eye. Teeth typical of the genus. The head, nape, breast, and pectoral base naked, or opercle sometimes with one or two scales near upper margin.

First dorsal low, not reaching second dorsal when depressed, 3 to 3.3 in head; second dorsal and anal also low, far short of caudal when depressed, second dorsal 1.9 to 2.4, anal 2.25 to 2.4, pectoral and ventral 1.5 to 1.8 times in head; least depth of caudal peduncle 1.66 to 1.75 times in length; ventral reaching anus or broad, thick, anal papilla.

The male type has the depth 3.3, caudal 2.9, head 2.7 times in length; eye 3.25, snout 1.85, postorbital 1.9 times in head; vertical fins all low, first dorsal 2.8, second dorsal 2.5, anal 2.8 times in head; pectoral 1.4, ventral 1.7 times in head; least depth of caudal peduncle 1.66 times in own length.

In life butter-yellow, with 4 broad black bands over back; first band extending from nape to anterior part of first dorsal, anterior portion extending down upon opercle, rear portion running down beneath pectoral to meet its fellow on abdomen; in young specimens there are two bands which unite to form the wide band just described; second band extending from insertion of first dorsal to middle of second dorsal base, with a belt extending below second dorsal to middle of anal base; third band behind vertical fins, fourth on caudal base, third and fourth on under side of caudal peduncle; snout and interorbital dusky, sides and under part of head sprinkled with black dots; pectoral with a black spot on base; other fins all clear, except where crossbands touch dorsals. In alcohol the yellow fades to whitish, markings unchanged.

Described from two female types, 13.5 and 14 mm long, and a male type, 11.5 mm long, from Dumaguete, Oriental Negros Province. One hundred paratypes, 11 to 44 mm long, were also taken at the same time. With these were 14 young, ranging down to 6.5 mm in length.

From Kabili River, British North Borneo, were collected 67 paratypes, 9 to 15 mm long.

All Dumaguete specimens, collected December 26, 1936, 11.5 mm long, were in breeding condition. Males begin to breed at that length, but never attain the size, neither in length nor in thickness, of females. The latter start breeding at a length of 12 mm and become very bulky, with protuberant abdomen. Few of the Kabili River specimens, collected February 5 and 6, 1937, were in breeding condition.

Unlike most gobies, this little fish congregates in schools containing up to 100 or 150 or more individuals. These fish like to congregate in shaded eddies and backwaters of small streams, protected by logs or roots. Nearly all the Dumaguete specimens were taken from such localities; a few were taken from small brackish-water pools in an adjoining nipa swamp. After one makes a dash with a dip net into a school, the remaining individuals disperse and dive to the bottom to hide.

The Kabili River specimens were taken from tiny pools in a mangrove swamp which was brackish part of the time. Swarms of them were seen in very shallow water filled with mangrove roots which prevented their capture.

Aggregatus, crowded together, in allusion to their habit of forming schools.

MACGREGORELLA BRAVOI sp. nov. Plate 5.

Dorsals VI, I, 9; anal I, 8; scales in longitudinal series 35, plus 1 or 2 on caudal base; transverse series 18; predorsals 6 to 10.

Depth 5.4 to 5.6, head 3, caudal 3.3 to 3.5, pectoral 3.75 to 4 times in length. Width of head 1.3 times, depth twice in own length. Eyes small, laterodorsal, 7 times, snout 4 times in head.

Dorsal and ventral profiles nearly horizontal and parallel, breadth of trunk 1.9 times in width of head. Mouth wide, short, oblique, not extending more than half way to a vertical from eye; teeth very small, in 4 rows, those of outer row in lower jaw enlarged and curved backward. Vertical fins all low; first dorsal reaching second dorsal origin when depressed, 2.8 to 3.3 in head; second dorsal and anal scarcely reaching broadly rounded caudal when depressed, 2.3 to 2.5 times in head; pectoral about 1.25 times in head; short broad ventrals completely united as in all members of the genus, 1.8 times in head. Least depth of caudal peduncle 1.3 times in own length in type.

On margin of snout a row of short, erect, fringed barbels, a second row before eyes; a row of 6 short barbels running back

on each side from chin; another row of small barbels running back from angle of mouth; behind eyes a crossrow of 5 sensory papillæ; on cheek 3 longitudinal rows of papillæ and 3 short vertical rows on opercle; another row passing along outside of eye and running back to nape, which may have several other very short rows.

In alcohol very pale tan, with 5 brown crossbars; first crossbar on top of head, second over pectoral base, third under first dorsal, fourth and fifth under second dorsal; a broad brown band extending from upper angle of pectoral to caudal base; a large brown bar or blotch across pectoral base; a brown bar or rows of brown spots on first dorsal; second dorsal and caudal crossbarred by rows of brown spots; caudal base also with a large dark-brown spot above and below; other fins colorless.

Described from the type, 30 mm long, and 4 paratypes, 24 to 28 mm long, from Nasugbu, Batangas Province, Luzon. Another paratype, 32 mm long, was taken by me at Waigiu, in the Dutch East Indies; another specimen from Waigiu is 14 mm long.

This very distinct species is merely an extreme type of *Macgregorella*, having few or no ridges on the head, but instead, short barbels and papillæ. However, its general appearance denotes close relationship to the other species of *Macgregorella*. The typical goby ventrals separate it from *Callogobius*, which it otherwise resembles in various respects.

I take pleasure in naming this species for Mr. Pablo Bravo, my artist for many years.

ELEOTRIDÆ

BORODA ALBO-OCULATA Herre.

Boroda albo-oculata HERRE, Gobies of the Philippines (1927) 58.

Two specimens from Nasugbu, 23 and 88 mm long. Hitherto known only from a series taken at Taytay, Palawan.

HERREOLUS FORMOSUS H. M. Smith. Plate 6.

Herrea formosa H. M. SMITH, Proc. U. Nat. Mus. 79 (1931) 40.

Seven specimens, 12 to 15 mm long, were taken from a tide pool at Dumaguete, Oriental Negros Province. Dorsals VI, I, 12 or 13; anal I, 12 or 13; ventral I, 3. Four specimens, 13 to 31 mm long, were captured with a dip net at Port Holland, Ba-

silan. A school of these fish lived in the growth on the piling of the wharf, whence they would emerge and swim about freely on the surface of the water, which is deep enough for ships to lie alongside the dock. At the slightest alarm they would dart back into the protection of the growth on the piling, so that it was very difficult to get at them. The Port Holland specimens had dorsals VI, I, 13 to 16; anal I, 12 to 15. However, there can be no question of their identity with those from Dumaguete.

Doctor Smith had only one specimen, 23 mm long, from an island in the Gulf of Siam. My specimens agree with his in every respect except that his has 5 spines in the first dorsal and some of the Port Holland specimens have a larger number of dorsal and anal rays.

A narrow black stripe extends along the middle of the back from the tip of the snout to the caudal base; a broad black stripe runs from the lower jaw across the lower half of the eye and along the side to the tip of the caudal fin.

The name *Herrea* was preoccupied.

VALENCIENNEA VIOLIFERA Jordan and Seale.

Valenciennea violifera JORDAN AND SEALE, Bull. Bur. Fish. 25 (1906) 383, pl. 52, fig. 2.

Two typical specimens, 38 and 45 mm long, were taken at Nasugbu, Batangas Province. This handsome species was described from Samoa, where it is common. It was also collected at Bais, Oriental Negros, by the late Dr. Bashford Dean, in 1900–1901, but has not been obtained in the Philippines since.

GOBIIDÆ

BATHYGOBIUS NOX (Bleeker).

Gobius nox BLEEKER, Nat. Tijds. Ned. Ind. 1 (1851) 248.

Bathygobius nox HERRE, Gobies of the Philippines (1927) 116.

Three specimens from Nasugbu, Batangas Province, and 5 from Dumaguete, Oriental Negros Province, 22 to 41 mm long. New to the Philippines. This very rare species has been known from a few specimens described by Bleeker from the East Indies, and one specimen taken at Hongkong. It may be recognized by its uniform black or dark-brown color.

CRISTATOGOBIUS LOPHIUS Herre.

Cristatogobius lophius HERRE, Gobies of the Philippines (1927) 170, pl. 13, fig. 1.

Ten specimens, 17 to 29 mm long, were taken at Nasugbu, Batangas Province. In males the third dorsal spine is elongate,

reaching to the middle of the base of the second dorsal. The second dorsal and anal fins extend upon the caudal fin when depressed.

In life males have a blue spot on each scale on the posterior half of the body, and 3 or 4 rows of blue ocelli on the membrane of the second dorsal and on the upper half of the caudal. The ocelli turn white in preserved specimens. Previously known only from 2 specimens from Bungau, Sulu Province, and 1 from San Jose, Antique Province.

CTENOGOBIUS SULUENSIS (Herre).

Rhinogobius suluensis HERRE, Gobies of the Philippines (1927) 193, pl. 14, fig. 3.

Three specimens, 40 mm long, from Loay, Bohol. Hitherto reported from Bungau, Sulu Province, and Hathorn Sound, New Georgia Island, Solomon Islands.

GNATHOLEPIS DAVAOENSIS Seale.

Gnatholepis davaoensis SEALE, Philip. Journ. Sci. § A 4 (1909) 537.

Seale's type, from Samal Island, Gulf of Davao, was destroyed long ago. The species since then has been known from 19 specimens collected at Dumaguete, Oriental Negros Province, and 3 from Sitankai, 17 to 35 mm long.

At Nasugbu I secured 25 specimens, 18 to 32 mm long. Each scale on the upper third of the body has a circular black dot. The anal has 1 or 2 rows of black ocelli, the young 1, the adults 2 rows, one basal and one median. These ocelli alternate with large yellow spots, which become white in preserved specimens. The caudal has 5 to 8 rows of ocelli; those of the basal row are large and in a straight row; the others are in curved or angulate rows and much smaller, the posterior ocelli progressively smaller.

GNATHOLEPIS DELTOIDES (Seale).

Gobius deltoides SEALE, Occ. Papers Bishop Mus. 1 (1901) 125.

Gnatholepis deltoides HERRE, Gobies of the Philippines (1927) 133.

Nine typical specimens, 19 to 47 mm long, from Sitankai.

This wide-spread Polynesian goby has been known in the Philippines from a single specimen taken at San Juan, Siquijor.

GNATHOLEPIS GEMMEUS Herre.

Gnatholepis gemmeus HERRE, Gobies of the Philippines (1927) 135, pl. 9, fig. 3.

Fifty-two specimens, from 18 to 42 mm long, were taken at Dumaguete, Oriental Negros Province, and 78, from 12 to 34 mm long, at Sitankai.

In life this handsome little fish has brilliant emerald spots and dots all over the sides, with clusters of gold spots along the middle of the sides of the head and body. The anal has 2 rows of violet ocelli, alternating with vertically elongate yellow spots The caudal is crossbarred with 5 or 6 rows of violet ocelli.

In alcohol the golden spots fade to pearl or bluish, with a black margin, the ocelli on the anal and caudal usually become black or dark brown, and most or all spots on the caudal disappear, except the basal row. The yellow spots on the anal turn white.

HERREA PRODUCTA (Herre).

Galera producta HERRE, Gobies of the Philippines (1927) 104, pl. 7, fig. 3.

Herrea producta (HERRE), Philip. Journ. Sci. 59 (1936) 368.

The name *Galera* was preoccupied; it was changed to *Herrea* by Whitley.[1]

Two young specimens, 25 and 27 mm long, were collected at Dumaguete, Oriental Negros Province.

Dorsals VI, I, 11 or 12; anal I, 9 or 10; about 100 scales in longitudinal series. In adults there are from 70 to 90 scales, the posterior scales becoming larger and fewer with age. The predorsal region is scaled nearly to the eyes; the opercles are scaled and the preopercles are at least partially scaled above. The original description erred in saying the head and body before the first dorsal are naked.

MARS CÆRULEO-MACULATUS Herre.

Mars cæruleo-maculatus HERRE, Copeia (1933) 22.

Three specimens, 22 to 36 mm long, were collected at Dumaguete, Oriental Negros Province; previously known only from Jolo. Dorsals VI, I, 9 or 10. Scales in longitudinal series 60 to 65.

MACGREGORELLA INTONSA Herre.

Macgregorella intonsa HERRE, Gobies of Philippines (1927) 100, pl. 7, fig. 2; Fishes Herre Philip. Exp. 1931 (1934) 81.

Twenty-one specimens from Nasugbu, Batangas Province, and 26 from Dumaguete, Oriental Negros Province, 12 to 48 mm long.

MACGREGORELLA MOROANA Seale.

Macgregorella moroana SEALE, Philip. Journ. Sci. § A 4 (1909) 533; HERRE, Gobies of Philippines (1927) 102, pl. 28, fig. 1; Fishes Herre, Philip. Exp. 1931 (1934) 81.

[1] Austral. Zoologist 6 (1930) 123.

Twelve specimens, 26 to 60 mm long, were taken on the reef at Sitankai. Previously known from the type, 38 mm long, taken at Jolo, one specimen from Dumaguete, Oriental Negros, and one at Sitankai.

STIGMATOGOBIUS TAMBUJON (Bleeker).

Gobius tambujon BLEEKER, Nat. Tijd. Ned. Ind. 7 (1854) 319.

A specimen, 24 mm long, from Dumaguete, Oriental Negros Province, was determined as this species by Dr. F. P. Koumans, the Dutch specialist on gobies. Previously recorded only from Java and Bali; new to the Philippines.

Dorsals VI, I, 7; anal I, 6; 25 scales in a longitudinal series, plus 2 on caudal base. Maxillary reaching beneath posterior part of eye.

VAIMOSA BIKOLANA Herre.

Vaimosa bikolana HERRE, Gobies of Philippines (1927) 151, pl. 11, fig. 2.

This species, described from 6 specimens 23 to 26 mm long, taken at Barrio Puru, Legaspi, Albay Province, proves to be abundant in Bohol and occurs also in North Borneo. The Bureau of Science collection contained a couple of hundred from 12 to 34 mm long, from Comon River, and many from 18 to 32 mm long, from Haya River, Bilar, Bohol. Nine specimens were taken from a brook at Tawau, and 3 from Kabili River near Tawau, British North Borneo.

ILLUSTRATIONS

[Drawings made by Pablo Bravo.]

PLATE 1. *Gobius elmeri* sp. nov.; × 7.
PLATE 2. *Vaimosa cardonensis* sp. nov.; × 7.
PLATE 3. *Vaimosa fusca* sp. nov.; × 5.
PLATE 4. *Brachygobius aggregatus* sp. nov.; × 8.
PLATE 5. *Macgregorella bravoi* sp. nov.; × 6.
PLATE 6. *Herreolus formosus* Smith.

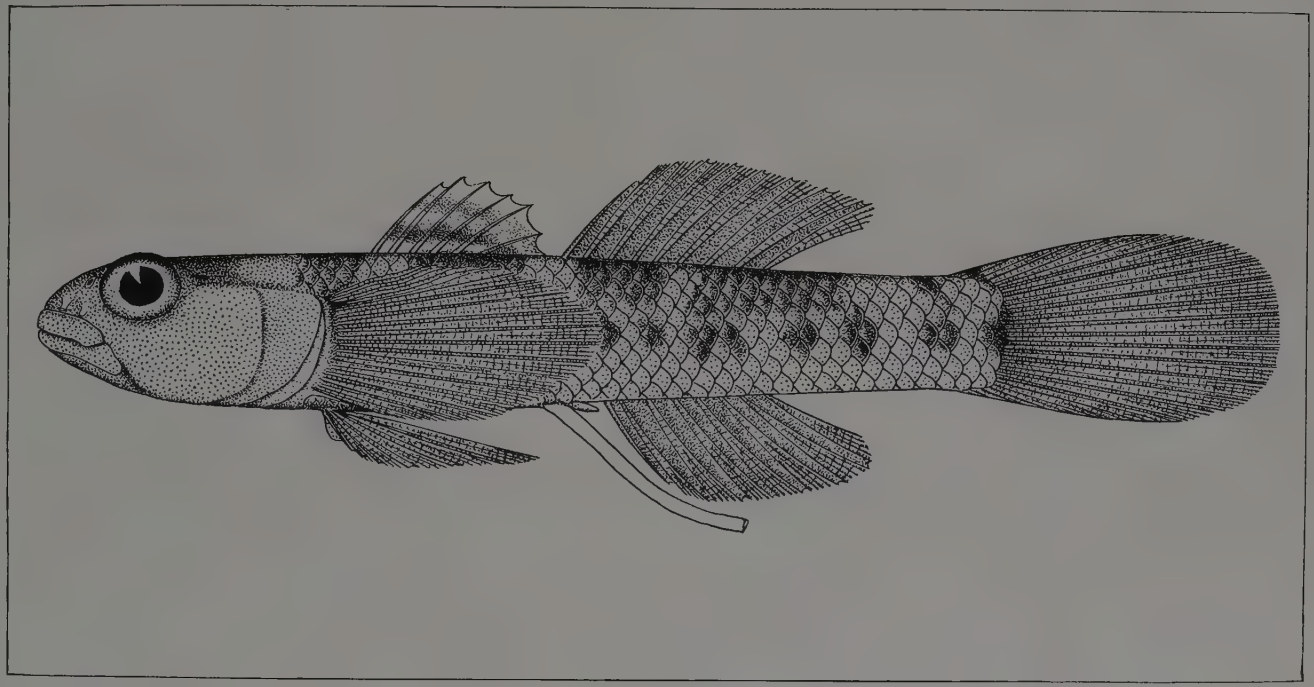


PLATE 1. GOBIUS ELMERI SP. NOV.

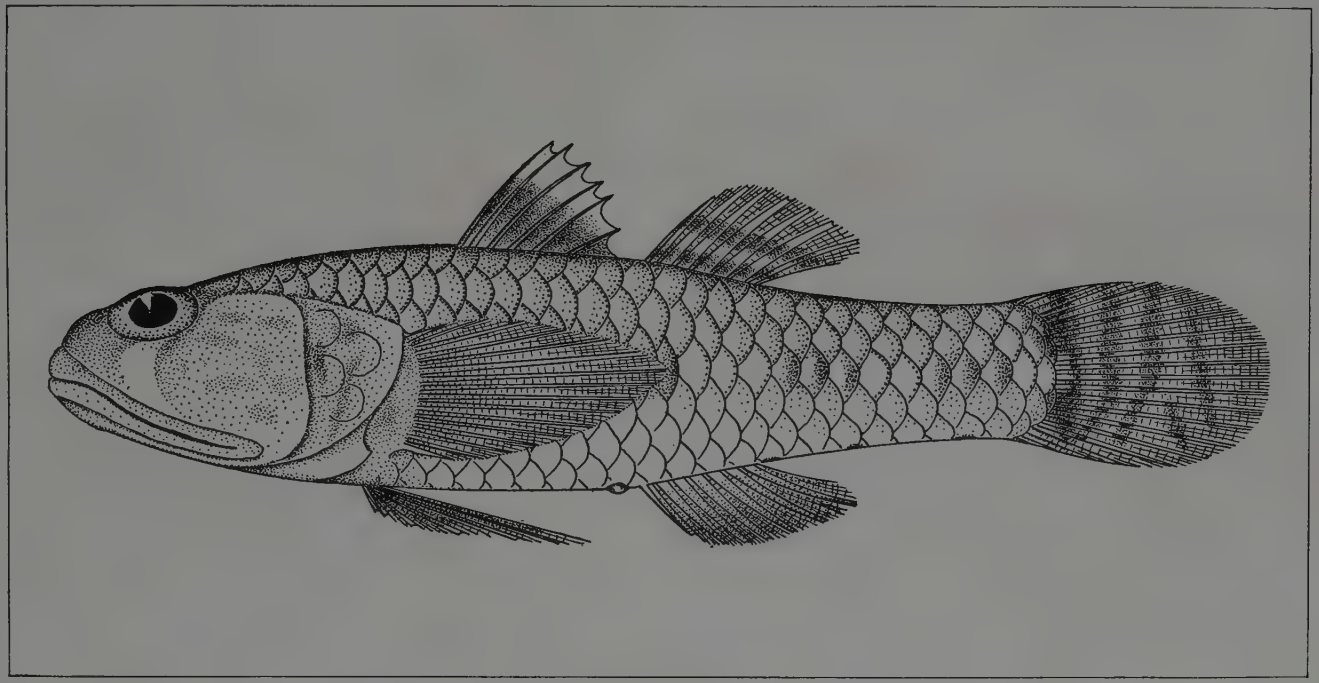


PLATE 2. VAIMOSA CARDONENSIS SP. NOV.

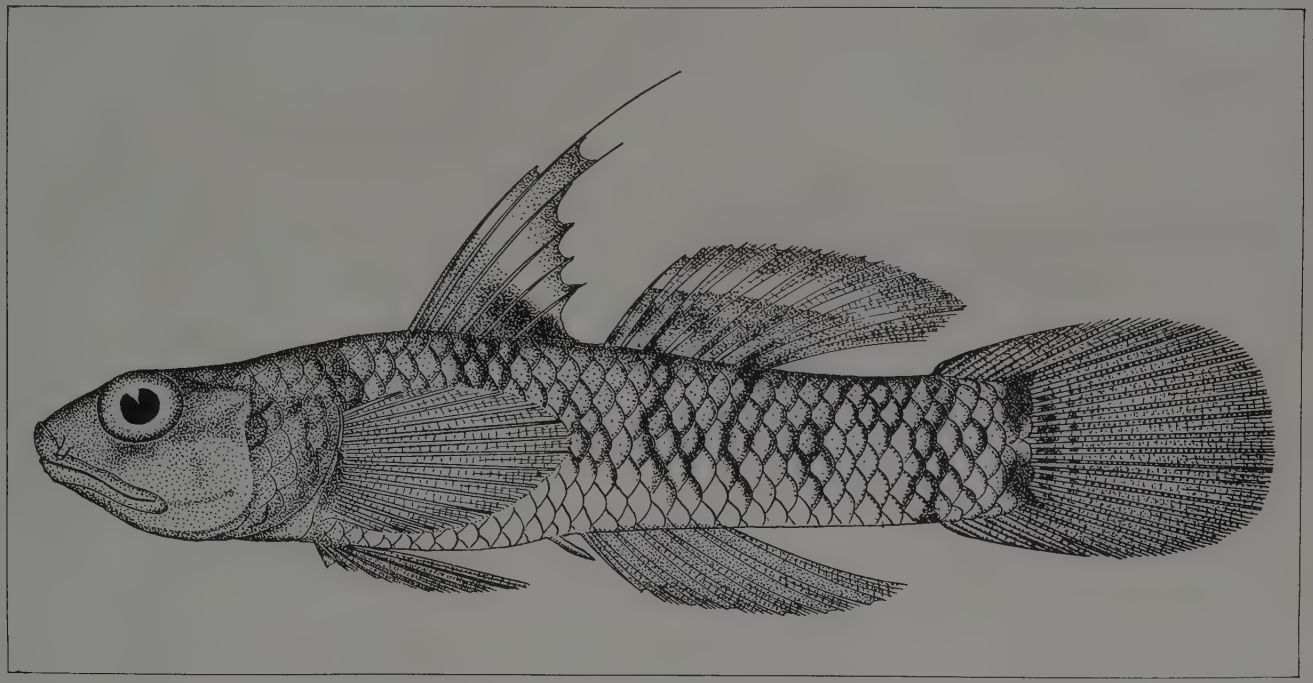


PLATE 3. VAIMOSA FUSCA SP. NOV.

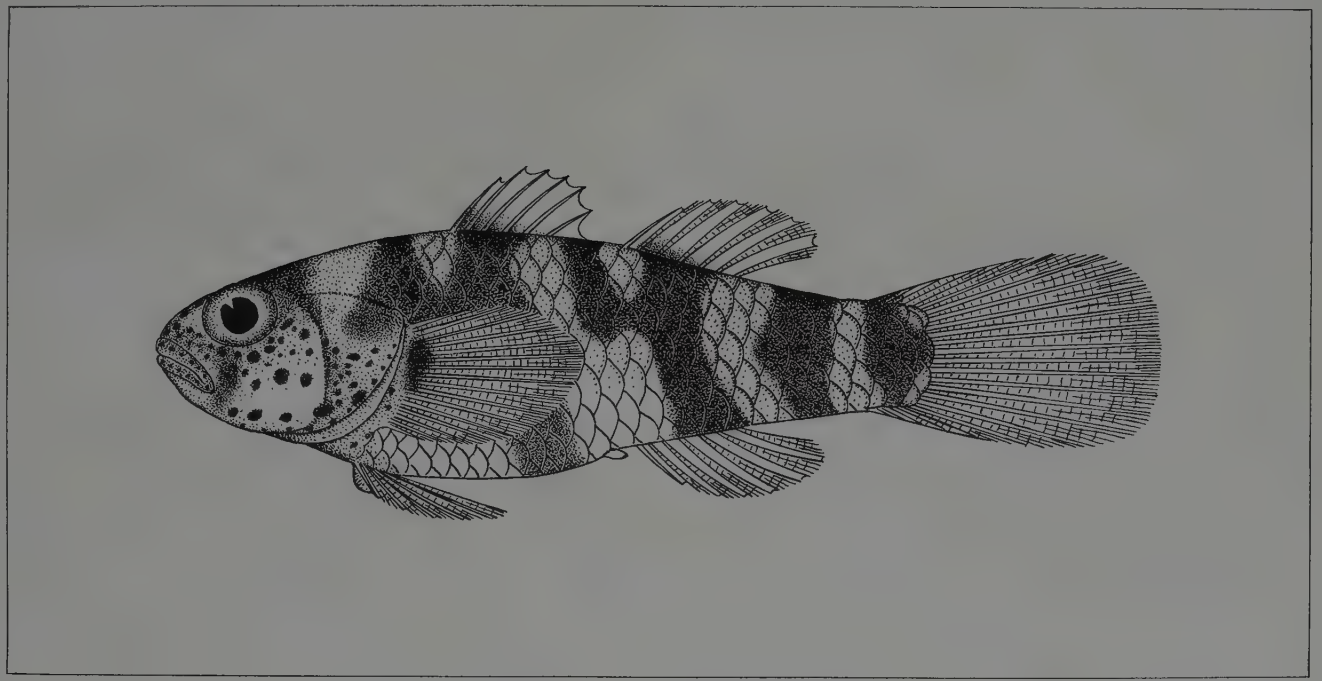


PLATE 4. BRACHYGOBIUS AGGREGATUS SP. NOV.

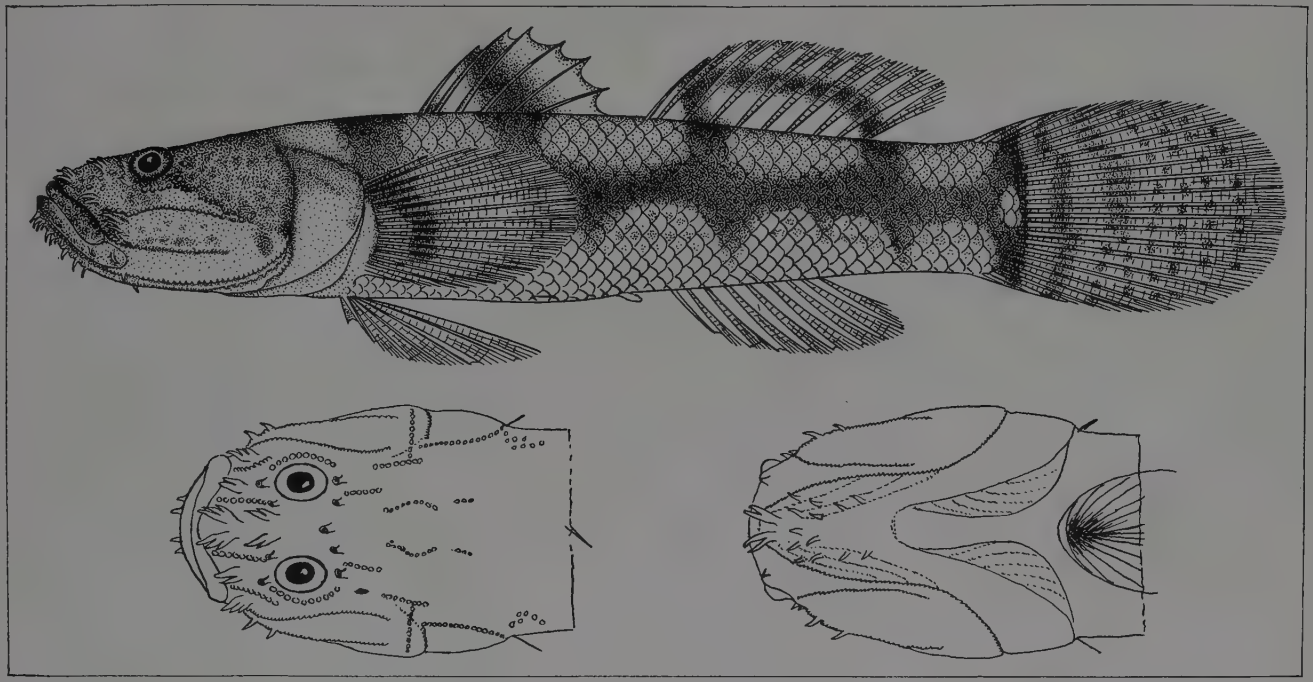


PLATE 5. MACGREGORELLA BRAVOI SP. NOV.

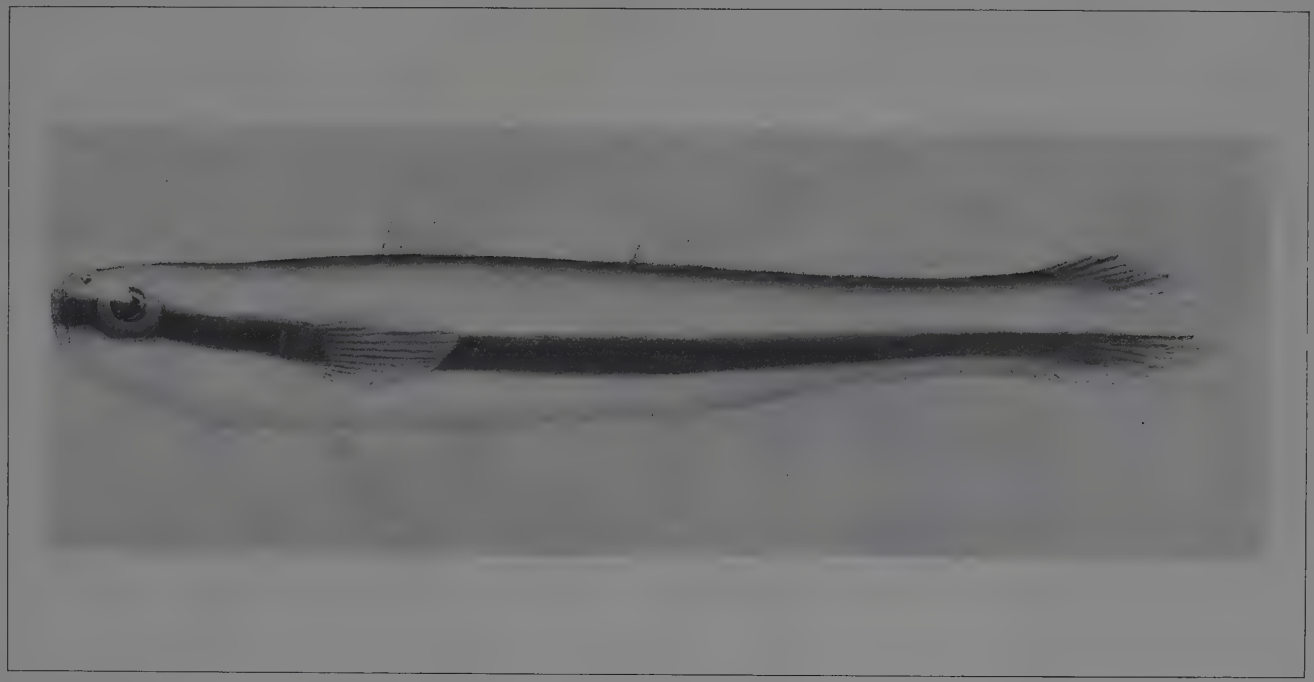


PLATE 6. HERREOLUS FORMOSUS SMITH.

THE FISHING INDUSTRY OF MARGOSATUBIG

By Jose S. Domantay

Of the Division of Fisheries
Department of Agriculture and Commerce, Manila

SIX PLATES AND TWO TEXT FIGURES

Margosatubig (text fig. 1), on the coast of Igat Bay (Plate 1, fig 1), is the most important fishing center in Zamboanga Province. It forms the blind end of Dumanquilas Bay, the mouth of which opens into Celebes Sea. Apparently Celebes Sea is the source of herrings, anchovies, Spanish mackerels, chub mackerels, tuna, bonito, and many other species of fish that make Igat Bay noted as a very rich fishing ground, and the town of Margosatubig a very important fishing center in Southern Mindanao.

The richness of Igat Bay and Port Sibulan in fishes is explained by their location (text fig. 1). Appearing like a huge fish corral, they serve as the terminal pounds, Flecha Point and Olutanga Island serving as the wings leading to Dumanquilas Bay as the inclosure. Schools of anchovies and sardines pursued by larger fishes in the open sea usually seek shelter in these places.

Other fishing grounds in the neighborhood are Maligay Bay, West Talusan Bay, Gapi Bay, Silupa Bay, Tumalung Bay, and the whole neighborhood of Olutanga Island. Igat Bay is around 5.6 kilometers wide between Latas Islands and Igat Point, and extends 8 kilometers southwestward, forming a safe and commodious harbor as well as a natural abode of fishes. It is said that the herring and anchovy fisheries of Igat Bay were at one time the richest in all southern Mindanao. Now there is a marked depletion of these fishes, due apparently to the alleged rampant illegal fishing with explosives and poisonous substances, in addition to overfishing with the use of luminous lights in connection with finely woven abacá nets known locally as *pukot.*

FISHING METHODS

Pukot.—The principal gear in this bay is the pukot used in conjunction with strong light during dark nights. The pukot

(Plate 1, figs. 2 and 3; text fig. 2) is a kind of seine. The fishing outfit is composed of several vintas each with a luminous lamp, and a pukot. The pukot is made of finely woven abaca cloth and sometimes of rice sacks. It is around 20 meters long and 2 meters deep, with a pocket from 7 to 10 meters long. The proximal third of the float line is provided with wooden floats 15 by 8 centimeters, with an interval of about 30 to 40 centimeters between floats, while the distal two-thirds, which is closer to the pocket, has its wooden floats closely strung together, at an interval of from 5 to 10 centimeters (Plate 1, fig. 3). In some pukot the distal third of the pocket is made of a coarser abaca cloth of 3-millimeter mesh.

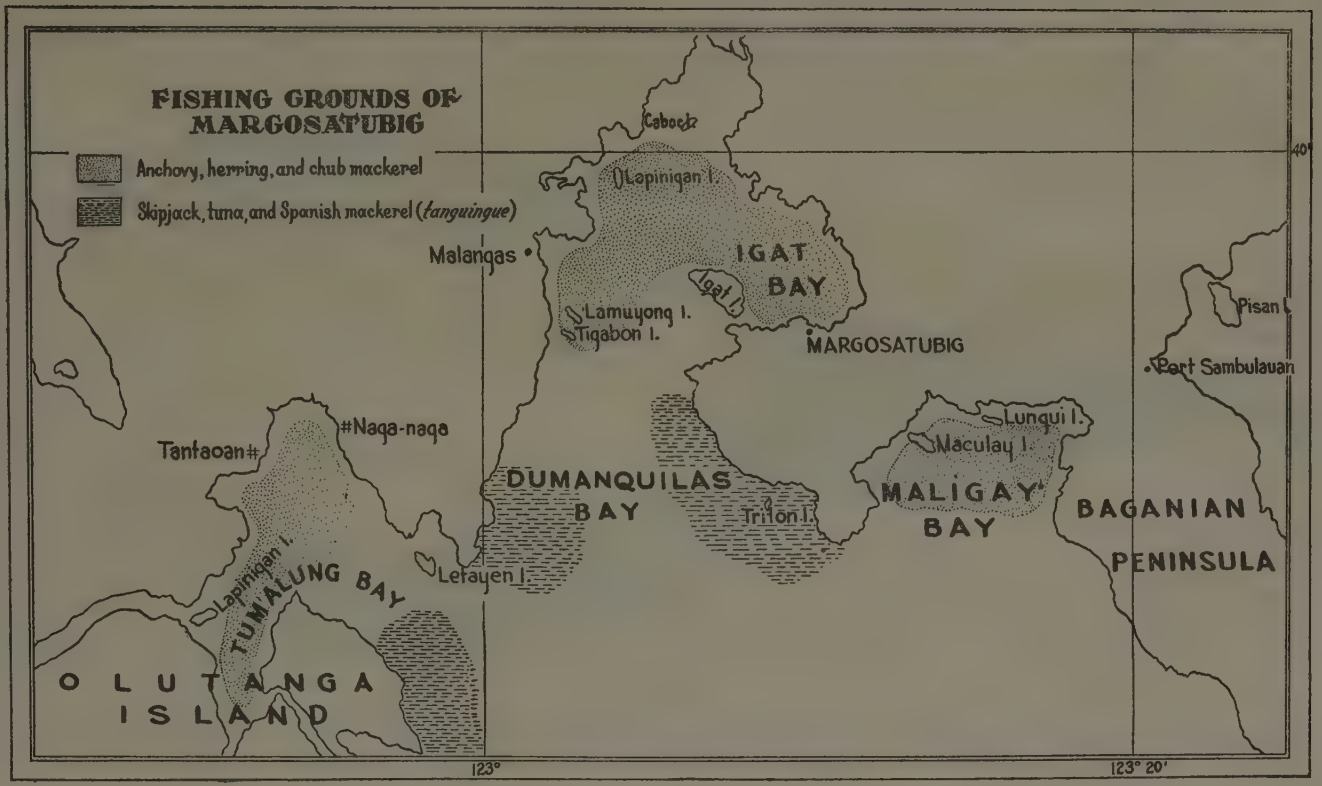
The lamp is hung from a wooden crosspiece at the bow of a vinta (Plate 2, fig. 3) manned by one or two fishermen. There are at present around 136 luminous lamps of different makes, varying from 800 to 1,800 candle power.

Vintas usually start from the shore at about 5.30 P. M. and reach the fishing ground at dusk. The luminous lamp is then set to attract the fish. The fish are kept under the rays of the light for at least two hours. Fishes subjected to strong light for some time begin to manifest signs of restlessness by twirling and twirling around, mostly in unison. This is the time when the vinta is paddled very slowly and gently toward a red light near the shore where the net is located.

It has been observed that fishes of similar size usually group together. Although the schools attracted are predominantly of one species, other species may be admixed. Schools of small anchovies, large anchovies, small sardines, large sardines, and chub mackerels, with a few squids, have been most attracted by light.

There may be as many as twenty or more fishing vintas with lights working together under one pukot. The vintas do not attract the fishes toward the net at the same time but one after another, allowing a good interval of time and distance between each, so that the fishes would not be disturbed. As a vinta leads the fishes to the net, other vintas with similar or stronger light should not pass nearby.

When a vinta approaches the net, the rays of the light are concentrated into a smaller area by means of a tin shade placed around the lamp. At the same time the light is dimmed by means of a red cloth, apparently to prevent the fishes from noticing the presence of the net and fishermen. The pukot is


FISHING GROUNDS OF MARGOSATUBIG
Anchovy, herring, and chub mackerel
Skipjack, tuna, and Spanish mackerel (tanguingue)
Caboelz
Lapinigan I.
Malanqas
IGAT BAY
Igat I.
Lamuyong I.
Tigabon I.
MARGOSATUBIG
Pisan I.
Port Sambulauan
Lunqui I.
Maculay I.
#Naqa-naqa
Tantaoan#
DUMANQUILAS BAY
Triton I.
MALIGAY BAY
BAGANIAN PENINSULA
Lapinigan I.
TUMALUNG BAY
Letayen I.
OLUTANGA ISLAND
123°
123° 20'
40'

41606—2

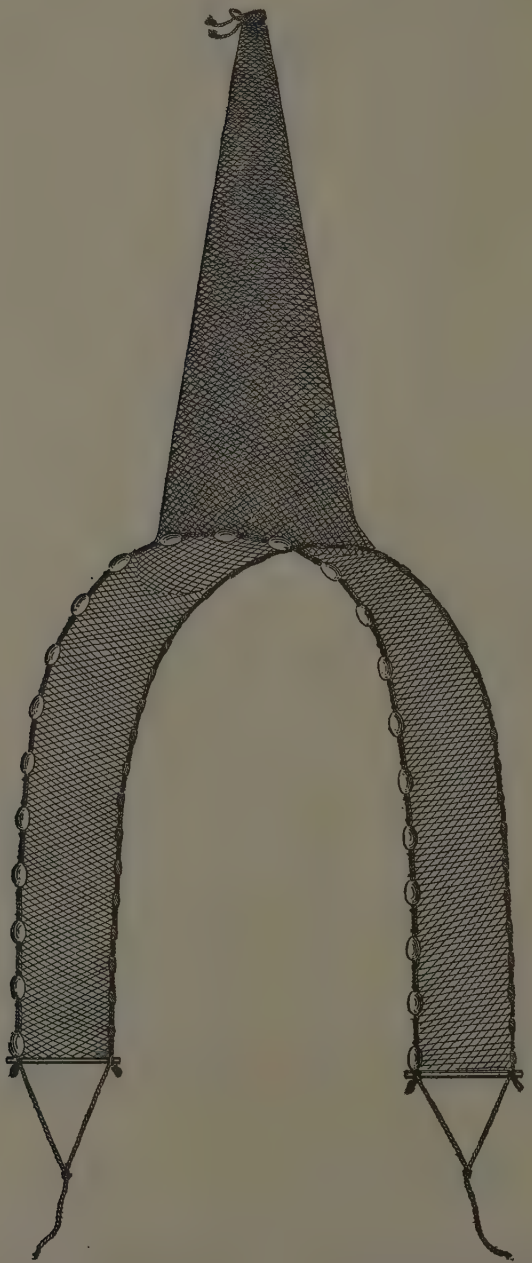


FIG. 2. Diagram of the pukot used in conjunction with fishing lamps.

usually placed in a V-shaped position against the current, with the end of one wing generally tied to a pole and that of the other usually operated by fishermen. At the middle of the net is the wide opening of the bag which narrows distally into the pocket with its opening closed by a cord. The fishes are ultimately enclosed inside the pocket from where they are emptied and loaded into the same vinta that brought the fishes to the net. After each haul the fishing vinta returns to the fishing ground and the process is repeated at least three or four times, during a dark night. During moonlight nights the vinta stays long in the fishing ground and waits for darkness, and may have only one or two operations, depending on how soon the moon goes down. The vinta may change places occasionally to look for a richer ground.

On the following morning the catches are delivered to Chinese fish dealers who own the luminous lamps and the vinta. They are measured in a bejuco basket supposedly of the same content as a petroleum can (Plate 3, figs. 2 and 3; Plate 4, fig. 1). The Chinese fish dealers merely wait at their wooden platforms or *batalan,* which are constructed adjoining their stores over the shoreline. These platforms are also used for drying fish during sunny days (Plate 4, figs. 2 and 3; Plate 5.)

The catch of a vinta is usually divided into two parts, one-half going to the owner of the lamp and the vinta, and the other half to the fishermen who are paid in cash or in terms of other commodities taken from the Chinese store. The owner of the lamp and vinta pays the owner of the net 7 centavos for every basket of fish caught. This amount in turn is divided between the owner of the net and the fishermen who operated it. One-third goes to the owner of the net and two-thirds to the fishermen.

Ampis.—The *ampis* is another fishing gear used in Igat Bay. It is made of finely woven abacá cloth, and is used in catching small shrimps (*Palæmon* spp.) known as *alamang.* The net is only used during the day. The shrimps are caught in very shallow tidal waters.

Lantao.—The *lantao* is a type of gill net, made of a regular fishing net of 1-inch (2.5 cm) mesh, which is usually used by the Moros. It is 18 meters long and 9 meters deep. It is usually anchored in deeper water and placed against the current. The float line is provided with wooden floats, and the lead line is weighted with small pieces of lead or shells.

Bobo.—The *bobo* is a small fish trap, made of bamboo, usually used by Moros (Plate 6, fig. 1).

Hook-and-line.—The hook-and-line method is used also by some Moro fishermen fishing with light.

Arrow.—The arrow is usually used with an improvised gun (Plate 6, fig. 2) in catching large fishes during the day. This is a very common fishing implement used by Moros.

Fish corral.—The fish corral (*bunsod*) is very popular among fishermen outside Igat Bay. Out of the 59 fish corrals registered in Margosatubig in 1937, only one is owned by a Christian Filipino; the rest belong to Moros. All corrals are of the ordinary simple pahubas type with three compartments. They are made of small wooden piles with bamboo matting called *banata* or *sigid*, tied together by vines called *bagin*. The bunsod has three heart-shaped compartments, the *sagaran* and the *ligaw*, and the terminal pound, called *bolsa*. The two wings are known as *pako-pako* and the leader is called *taktakon*. The leader is exceptionally long. These corrals are usually constructed in shallow waters about 3 meters deep. They are built at a cost ranging from 100 pesos [1] to 200 pesos. Most of them are good for only 3 to 6 months. They are constructed the year round, except in places that are exposed to strong wind throughout the year.

METHODS OF FISH PRESERVATION

As in other important fishing centers, a large quantity of fish is preserved in Margosatubig for export to other localities. Several methods of preserving fish are employed.

Bagoong or guinamos.—Bagoong, the fermented product of small fishes, is produced during rainy days. The fishes used are mostly anchovy (bolinao) although small sardines (lupoy) are used at times. Ten 5-gallon cans of fresh fish are usually mixed with $1\frac{1}{5}$ sacks (60 kilograms) of salt. The mixing is usually done in a *pandan* or bejuco mat, after which the salted fish is placed on empty petroleum cans. A wooden vat is sometimes used for the salting of fish. After the fish are placed in cans and inspected and certified by the sanitary inspector, the cans are sealed and stored for about a week before marketing.

Drying.—Drying fish is usually done during sunny days, when this method of fish preservation is more profitable than making

[1] One peso equals 50 cents United States currency.

bagoong. Depending on the amount of salt used, two methods of drying are employed.

As soon as anchovies are unloaded from the fishing boat to the drying platform (batalan), any larger fish, like sardines, (*tamban*), and others that may have been admixed with them, are segregated. Pandan or bejuco mats are spread over the platform and the anchovies are scattered over them for sun-drying without salting. When the day is somewhat gloomy, a small amount of salt is added in the proportion of from 1 to 2 chupas of salt per can [2] of fish. Drying takes place from 1½ to 2 days, depending upon the brightness of the sun. A can full of fresh fish usually nets 5 kilograms of dried fish. When there is not sufficient sunlight to dry the fishes well the partly salted fish is made into bagoong by adding more salt. This is generally known as the *bolinao* method of drying.

Dried anchovies are usually placed in sacks for marketing. Three sizes of sacks are usually used. The large-sized sack weighs 35 kilograms, the medium-sized sack, 30 kilograms, and the small sack, 25 kilograms.

In the other methods, known as sardine drying, the sardines are generally dried with salt. According to the salts used, there are the Chinese method, which is used mostly in Margosatubig, and the Filipino-Japanese method. With the Chinese method sardines are salted in a wooden vat in the proportion of 10 cans fresh fish to 1 sack (50 kilograms) Zamboanga salt. The mixture is allowed 25 hours in the wooden vat, until the salt crystals dissolve and liquefy with the juice from the fish. After salting the fishes are washed in salt water and dried for 2 days. When thoroughly dried they are placed in a wooden box. A box of dried sardines usually weighs 70 kilograms.

The Filipino-Japanese method is similar to the Chinese method, with the following improvements:

For every ganta of salt used, 1 spoonful of *salitre* (Potassium nitrate or saltpeter) is admixed. If Ilocano salt is used, 10 spoonfuls of salitre is added to 1 sack of salt. The mixture of fish and salt is allowed to stand in the wooden vat for at least 12 hours to allow the fish to be thoroughly salted. After salting the sardines are washed in fresh water and dried. In this method the meat almost retains its natural color. When packed in boxes the products last longer because of the absence of salt particles outside the fish.

[2] This is an empty petroleum can with 5 gallons capacity.

Like sardines, cavallas (chub-mackerel) are dried according to the Chinese and the Filipino-Japanese method. With the Chinese method, after the chub mackerel is split lengthwise along the middorsal line leaving the ventral side uncut, the internal organs are removed and the fish is dry-salted. Salt is sprinkled over the flesh of the fish and the salted fish are piled one over the other on a mat. The piles of salted fish are allowed to stand for at least 3 hours, washed in sea water, and dried in the sun. The fish are dried for at least 2 days before they are bundled with rattan in batches of 50 each. These are later placed inside boxes or marketed without packing, depending upon the place where they are sold.

The Filipino-Japanese method is similar to the Chinese method, except for the following: One spoonful of salitre is added to one ganta of salt and the salted fish is allowed to stand for at least one hour. The product produced with the use of salitre has a rosy or pinkish flesh and better taste.

Binoro method.—Ten cans of fresh fish, mostly large sardines or cavallas, are salted for 24 hours, with one sack of Ilocano salt mixed with 10 spoonfuls of salitre. The salted fish are arranged in layers inside a box, and another ½ sack of the same salt, with 5 spoonfuls of salitre, placed between the layers of fish. A week later the product is marketed.

INCOME FROM FISHERIES

Although Igat Bay is still a good fishing ground, there is already a very noticeable decrease in the number of fish caught, compared with the catches of previous years. Alamang, which used to be very abundant several years ago, are hardly found today. The anchovies and herrings are now on the verge of depletion. It is believed that fishes migrate to Port Sibulan in the neighborhood of Naganaga and Tantaoan. This place being newly exploited would naturally yield greater catches than Igat Bay, which has long been exploited and over-fished. Thus the fishermen from Igat Bay seeking a richer fishing ground have migrated to Port Sibulan.

The fish business in Margosatubig several years ago had an estimated value of not less than 30,000 pesos a year. From 5,000 to 10,000 18-liter cans of fermented herring and anchovies (bagoong) were prepared every month. Nowadays, hardly 500 cans are produced. The amount of dried herrings and anchovies put up monthly has also decreased considerably. A fair quantity of chub mackerels, formerly prepared into salted fish (binoro),

TABLE 1.—*Common fishes and other marine products caught around Margosatubig.*

Local name.	English name.	Scientific name.
Arahan (gagok)	Sea catfish	*Arius thalassinus.*
Babansi (bigaong)	Theraponid	*Pelates quadrilineatus.*
Bagaong (langoot)	do	*Therapon jarbua.*
Do	do	*Therapon* spp.
Bagabaga (tihiktihik)	do	*Myripristis melanostictus.*
Bebang (isda kabakaba)	Butterfly fish	*Chætodon vagabundus.*
Bitilla (sampok)	Porgy	*Lethrinus opercularis,*
Bitilla (bahaba)	Snapper	*Lutjanus fulviflamma.*
Cavallas	Chub mackerel	*Rastrelliger chrysozonus.*
Dalagang bukid (sulig)	Caesio	*Cæsio cuning.*
Do	do	*Cæsio xanthonotus.*
Dumpilas (tigi)	Anchovy	*Scutengraulis hamiltonii.*
Do	do	*Thrissina bælama.*
Dilis (bolinao)	do	*Stolephorus commersonii.*
Do	do	*Stolephorus heterolobus.*
Gono	Silverside	*Atherina duodecimalis.*
Do	do	*Atherina* spp.
Hasa-hasa (tulay)	Mackerel	*Rastrelliger brachysomus.*
Katchorita (subad)	Bonito	*Euthynnus yaito.*
Kataba (sumpit or sampirot)	Archer fish or shooting fish.	*Toxotes joculator.*
Labahita (indangan or darong)	Surgeon fish	*Acanthurus bleekeri.*
Lapad (kandaman or tamban)	Herring	*Sardinella perforata.*
Majuara (gaodgaod or mulmul)	Parrot fish	*Scarus* spp.
Matang baka (katambak or tulay)	Bageye	*Selar crumenophthalmus.*
Mayamaya ((mangagat)	Snapper	*Lutjanus monostigma.*
Mangagat	do	*Lutjanus argentimaculatus.*
Malakapas	Mojarra (gerrid)	*Gerris abbreviatus.*
Pipicao (lapis)	Leatherjacket	*Scomberoides toloo.*
Salay-salay aso	Crevalle	*Caranx leptolepsis.*
Saramullete (tangbod)	Goatfish	*Upeneoides sulphureus.*
Saramullete (timbungan)	do	*Parupeneus luteus.*
Sapsap (lawaylaway)	Slipmouth	*Equula equula.*
Tarakitok (mamsa)	Cavalla	*Caranx malabaricus.*
Tarakitok (isda puti)	do	*Caranx (Carangoides) gymnostethoides*
Tamban (kasig)	Herring	*Dussumieria hasseltii.*
Do	do	*Sardinella leiogaster.*
Do	do	*Sardinella perforata.*
Do	do	*Sardinella fimbriata.*
Do	do	*Sardinella melanura.*
Do	do	*Sardinella sirm.*
Tambacol (panit or barellete)	Yellowfin	*Neothunnus macropterus.*
Tanguingui (tanigue)	Spanish mackerel	*Cybium commerson.*
Torcillo (lambana or tinduktinduk)	Barracuda	*Sphyræna obtusata.*
Tuakan (bolinao)	Anchovy	*Stolephorus indicus.*
Tulifigan (puyan)	Skipjack	*Katsuwonus pelamis.*
Baling (alamang)	Shrimps	*Palæmon* spp.
Baliscugay (pasayan)	do	*Penæus* spp.
Banagan	Spiny lobster	*Palinurus* spp.
Balat	Sea cucumber	Different species of *Holothuria,* etc.
Bangelan (kulabutan)	Cuttlefish	*Sepia* spp.
Cangrejo (alimango)	Crab	*Scylla serrata.*
Choca (pusit)	Squid	*Loligo* spp.

are also no longer available. In general it has been observed that the quantity of fish caught in 1939 was much less than that caught in 1938, which in turn was much less than that caught in 1937. The fishermen themselves corroborated this marked decrease in the number of fish caught annually. The fishery products from which the income of Margosatubig from fisheries is derived are shown in Table 1.

POSSIBILITIES OF FISHERIES IN MARGOSATUBIG

The importance of Margosatubig as a fishing center has been known since the early days of Christian occupation of the locality. However, this importance is gradually diminishing, and unless present malpractices are checked, the place may ultimately disappear from the fishing map of the Philippines.

Three important factors contribute to the well-marked depletion of fishes in Igat Bay, which directly affect Margosatubig as a fishing center; the most important of these is illegal fishing with explosives and poisonous substances. During the last few years twelve major accidents due to untimely explosion have been reported. It is claimed that many more accidents of this nature have occurred but were not reported. The use of poisonous substances like *lagtang* and *tubli* is becoming popular among native fishermen who fish with luminous light.

Pukot fishing, or the use of finely woven abaca nets in conjunction with luminous lights, is undoubtedly the second factor in importance contributing to the marked depletion of fish in Igat Bay.

Water pollution is considered the third factor responsible for the depletion of fishes in Igat Bay. Decaying sawdust and other waste materials of the Mindanao Lumber Sawmill dumped along the seashore has been observed to cause the death of thousands of fish along the shore.

ILLUSTRATIONS

PLATE 1

FIG. 1. General view of Margosatubig, showing the houses of the Chinese fish dealers and their drying platform (*batalan*).
2. A portion of the pukot, showing its long bag or pocket which is being dried on a batalan. In the background is the Igat Bay fishing ground.
3. A portion of the same net, showing the opening leading to the pocket, and the arrangement of the wooden floats.

PLATE 2

FIG. 1. Fishing vintas delivering their night catch to the Chinese fish dealers in the morning at the batalan.
2. A fishing banca with sapiao, landing its catch in the morning.
3. Some of the fishing vintas delivering their catch in the morning. The luminous lamps are shown attached to the bow of the vinta.

PLATE 3

FIG. 1. A typical Moro fishing vinta with large fishes being dried over the roof of the boat.
2. A Moro fisherman delivering his catch to a Chinese fish dealer, showing the measuring basket claimed to be equivalent to one petroleum can.
3. A closer view of the measuring basket.

PLATE 4

FIG. 1. Women segregating the larger fishes from an anchovy catch, showing the measuring basket.
2. Anchovies being dried on the batalan, showing some storehouses of Chinese dealers.
3. Another view of anchovies and herrings being dried.

PLATE 5

FIG. 1. Dried anchovies ready to be collected and stored in storehouses.
2. Tamban and bolinao being dried on the drying platform.
3. Chub mackerel being dried on drying platform.

PLATE 6

FIG. 1. A Moro fishing vinta with two fish traps (*bobo*), returning home from the fishing ground.
2. A Moro fisherman with diving goggles, demonstrating how he shoots a fish with his improvised gun loaded with a long, sharp, G. I. arrow.

TEXT FIGURES

[Drawn by Pio C. Medel.]

FIG. 1. Map of the different fishing grounds around Margosatubig.
2. Diagram of the pukot used in conjunction with luminous lamps.

PLATE 1.

PLATE 2.

PLATE 3.

PLATE 4.

PLATE 5.

1

2

PLATE 6.

ADDITIONS TO THE APHID FAUNA OF FORMOSA (HEMIPTERA), VI[1]

By Ryoichi Takahashi

Of the Agricultural Research Institute, Formosa

FIVE TEXT FIGURES

APHIS GLYCINES Matsumura.

Aphis glycines Matsumura, Journ. Coll. Agr. Sapporo 7 (1917) 387; Hori, Hokkaido Agr. Expt. St. Rept. 23 (1929) 107.

Wingless viviparous female.—Yellowish green. Cornicles cylindrical, black, greenish at basal part. Cauda long, a little shorter than cornicles, pale, with 7 setæ.

Winged viviparous female.—Yellowish green. Antennal segment three with about 8 circular sensoria in a row, segment four without them. Abdomen with a black patch at base of each cornicle. Cornicles black. Cauda elongate, slightly constricted about middle, pale, with 9 long setæ.

Host.—*Glycine soja.*

Habitat.—Taihoku.

Many specimens were taken by me, September 10, 1938. New to the fauna of Formosa.

STOMAPHIS YANONIS Takahashi.

Stomaphis yanonis Takahashi, Zool. Mag. Tokyo 30 (1918) 369; Proc. Ent. Soc. Washington 21 (1919) 176; Aphid. Formosa II. Dept. Agr. Res. Inst. Formosa Rept. 4 (1923) 139; III. ibid. 10 (1924) 116; Lingnan Sci. Journ. 9 (1930) 11.

Wingless viviparous female.—In specimens treated with caustic potash, head and prothorax brown, mesonotum with a large brown patch at middle and on each side; metanotum and basal seven abdominal tergites each with a pair of large brown patches on median area, sometimes confluent on metanotum and seventh tergite; metanotum with a brown patch on each side; basal seven abdominal tergites each with six small, transverse, dark-brown patches in a row along anterior margin; eighth abdominal tergite, cauda, and anal plate dark brown; second to sixth abdominal

[1] Part V was published in the Philip. Journ. Sci. 69 (1939) 25–33.

sternites each with a longitudinal dark-brown patch at median area; antennæ pale brown, paler on third segment; legs pale brown, sometimes darker on tarsi.

Head very short, defined from thorax, with a median suture on dorsum; each lateral part of dorsum of head defined distinctly from median area by a suture, on which eye is located. Eyes small, not protruding; three large facets representing ocular tubercles distinctly protuberant, sometimes longer than wide. Antennæ with many fine setæ, which are shorter than width of third segment; segment one stout, distinctly longer than wide, somewhat widened distally, much longer than setæ on body, dark, without setæ on basal half; segment two much smaller than segment one, narrowest near base; segment three much narrower than fore tibiæ, slightly swollen near base in many individuals, constricted at base, lacking sensoria; segment four very slightly narrowed towards base, with one to four small circular sensoria in a row, these sensoria sometimes entirely wanting; segment five constricted about middle and at base, with one to four small irregular sensoria on basal part, these sensoria sometimes wanting; segment six with a large, longitudinally oval sensorium, without accessory sensoria, not narrowed on the distal part; relative lengths of segments: III—42, IV—17, V—22, VI—24. Cornicles on large, dark-brown, hairy cones, diameter nearly length of dorsal setæ of body; cones on distal part with many smaller setæ mixed with fewer long setæ, long setæ as long as dorsal setæ of body, longer than antennal setæ, transverse diameter less than longitudinal. Femora well defined from trochanters; anterior tarsi rounded on dorsal side, distal segment about twice as long as basal segment; hind tarsi slightly longer than last antennal segment, distal segment about thrice as long as basal.

FIG. 1. *Stomaphis yanonis* Takahashi. Wingless viviparous female; antenna.

Body about 5 mm long.

Host.—*Celtis* sp., attacking the stem.

Habitat.—Sakahen, Karenko Prefecture.

Many specimens sheltered by an ant, *Lasius* sp., were taken by me August 7, 1939. Previously known only from China and Japan (Honshu).

As the original description is in Japanese and rather brief, the redescription is here given from the Formosan specimens, which exactly agree with the Japanese forms. Easily distinguished from *Stomaphis liquidambaris* Takahashi by the cones of cornicles being well defined, by the shorter hind tarsi, and by the dorsum of the body not dark throughout in specimens treated with caustic potash.

PARATRICHOSIPHUM NIITAKAENSE Takahashi.

Paratrichosiphum niitakaense TAKAHASHI, Philip. Journ. Sci. 63 (1937) 5.

Winged viviparous female.—Antennal segment three a little imbricated, somewhat stouter than tibiæ, slender, with 24 to 26 large, transversely oval sensoria arranged in a row along whole length, and with about 22 long setæ; segment four with about 5 setæ, lacking sensoria; relative length of antennal segments: III—50, IV—15, V—17, VI—12+?.

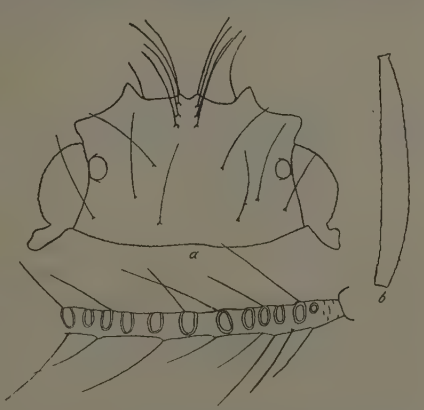


FIG. 2. *Paratrichosiphum niitakaense* Takahashi. *a*, winged viviparous female, head; *b*, winged viviparous female, basal part of antennal segment three; *c*, wingless viviparous female, cornicle with hairs removed.

Body about 2 mm long, forewing about 3.25, cornicle about 1.3.

Host.—*Quercus* sp.; attacking the young leaf and shoot.

Habitat.—Mount Noko (about 8,000 feet).

A single alate and four apterous females were collected by me, August 6, 1939. The original description was prepared from the specimens with broken antennæ and the above supplementary notes are given. The specimens from Mount Noko are larger than those from Niitaka. Differs from *Paratrichosiphum tenuicorpus* Okajima

in the cornicles being shorter, norrowed basally and pale in the apterous form, the larger oval sensoria on antennal segment three in the alate form, and in other respects. Easily differentiated from *Paratrichosiphum lithocarpi* Takahashi in the shape of cornicles, which are longer, and broadest at the base and narrowed towards the apex. Among the Formosan species of *Paratrichosiphum* the cornicles of the apterous form are pale (whitish or yellowish) in *P. niitakaense* Takah., *P. lithocarpi* Takah., and *P. tattakanum* Takah., and sometimes also in *P. tenuicorpus* Okajima.

EUTRICHOSIPHUM ELONGATUM sp. nov.

Wingless viviparous female.—Pale yellow, antennæ, legs, and cornicles pale. Body elongate, about twice as long as wide, broadest about middle of abdomen, with many very long, fine, simple setæ, and numerous minute granules on venter, and on anterior parts of meso- and metanotum and basal three abdominal tergites. Head widely convex at middle of front, with about 14 setæ on dorsum, a few of which are sometimes much shorter; frontal setæ longer than basal two antennal segments taken together. Frontal tubercles very short, distinct. Eyes normal. Antennæ slender, about 1½ as long as cornicles, 5-segmented, with many long setæ, longer setæ nearly as long as dorsal setæ of head; segment three imbricated, longer than width of head including eyes; segment four with 3 or 4 setæ; segment five with 2 long setæ on basal part and 6 accessory sensoria in a group; relative lengths of segments: III—32, IV—10, V—9+12. Rostrum reaching hind coxæ. Pronotum fused with head, with many setæ, most of these on marginal area. Abdominal segments except basal and distal few segments fused, with many long dorsal setæ, which are as long as those on the head and not in rows; lateral setæ a little longer; a pair of long setæ present between cornicles; seventh tergite with a lateral seta; eighth tergite with 2 median setæ. Cornicles large, stout, about five times as long as wide, broadcast about middle, narrowed towards both ends, narrowest at apex, rounded on one side, not striate or reticulate, as long as hind tibiæ, much longer than width of head, shorter than width of abdomen, distinctly longer than antennal segment three, with many micro-

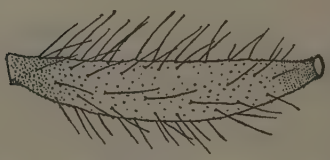


FIG. 8. *Eutrichosiphum elongatum* sp. nov. Wingless viviparous female; antenna.

trichiæ, these much fewer on middle part, and with many long bristles, these as long as dorsal setæ of body, not branched, absent on basal and distal small parts, and a little longer than, or as long as, width of cornicles. Caudal segment very short, lacking a process, with about 8 long bristles on hind margin. Trochanters defined from femora; femora imbricated on one side of distal half; tibiæ stouter than third antennal segment, with 3 slender spinelike setæ at tip, and some setæ which are as long as width of tibiæ; hind tibiæ distinctly striate; tarsi with some long setæ on basal segment.

Body 2.5 mm long, antenna about 1.25, cornicle about 0.9.

Host.—*Quercus* sp., attacking the lower side of young leaf and the young shoot.

Habitat.—Higashinoko, Karenko Prefecture.

Many specimens were collected by me August 6, 1939. This species possesses 5-segmented antennæ and is referred to the genus *Eutrichosiphum* Essig et Kuwana, though differing much from the known species of the genus in the elongate and pale body, in these respects resembling some species of *Paratrichosiphum* Takahashi.

SHIVAPHIS ARUNDINARIÆ sp. nov.

Winged viviparous female.—White, slightly dusky on thorax, without markings on abdomen, with cottony secretions on anterior part of body, on hind legs, and slightly on antennæ. Antennæ pale, very slightly dusky on basal two segments; legs, cornicles, cauda, and anal plate pale. Forewings a little clouded along first oblique vein, and distal parts of second and third; hind wings slightly so along oblique veins; stigma pale, darker at basal and distal parts; veins pale. Body oblong, soft, without long setæ and granules. Head with a few small simple setæ on dorsum, lacking a ventral projection; front slightly convex at middle above ocellus. Frontal tubercles short, but distinct, somewhat wider than space between them, divergent on mesal side. Eyes large, with ocular tubercles. Antennæ very long, slender, narrowed distally, with a few short, simple setæ, which are shorter than width of segment three; segment one about $1\frac{1}{2}$ times as long as wide, much larger than segment two, not convex mesally; segment two longer than wide; segment three very long, shorter than fore tibiæ, a little narrowed towards apex, not striate, without microtrichiæ, with 5 to 9 sensoria in a row on basal two-fifths except at basal part, these sensoria small and transversely oval; segment four without sensoria; segments five and six striate; distal part of segment six short,

about 5 times as long as wide, scarcely tapering; primary sensoria small, circular; relative length of segments: I—7, II—5, III—47, IV—25, V—21, VI—16+4. Rostrum short, stout, not reaching middle coxæ, distal segment nearly as long as wide, tapering; clypeus not convex. Dorsal tubercles wanting. Abdomen with many small wax pores around cornicles. Wings long; stigma short, truncate; stigmatic vein obsolete or absent; third oblique vein twice branched; hind wings with two somewhat divergent oblique veins and three hooklets. Cornicles very

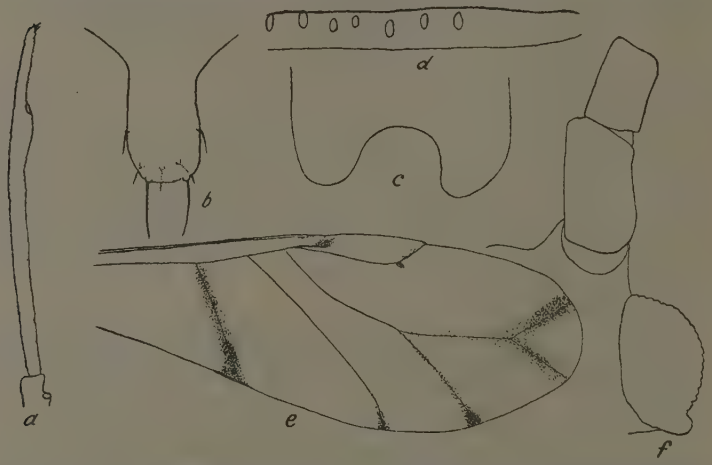


FIG. 4. *Shivaphis arundinariæ* sp. nov., winged viviparous female. *a*, last antennal segment; *b*, cauda; *c*, anal plate with hairs removed; *d*, basal part of third antennal segment; *e*, forewing; *f*, head.

short, almost mere rings, rather large in diameter. Cauda as long as anal plate, somewhat constricted basally, somewhat knobbed, rounded apically, with a pair of stouter setæ at apex. Anal plate deeply divided, U-shaped; lobes parallel, as wide as cauda. Legs long, slender; trochanters distinct; fore and middle femora constricted near base; all femora with many mosaiclike markings (wax pores?) on distal part; tibiæ stouter than distal part of third antennal segment, with about three slender spines at tip, and some simple setæ, which are as long as width of tibiæ; hind tibiæ distinctly stouter than other tibiæ, somewhat narrowed towards apex, densely with faint mosaiclike markings (wax spores?) over whole surface; tarsi with spinules in rows, some setæ on basal segment; hind tarsi much shorter than basal part of last antennal segment; empodial setæ not expanded.

Body about 2 mm, head including eyes about 0.392 mm wide, 0.2 mm long at median part, antenna 2.1 mm long, antennal segment three 0.76 mm long, 0.037 to 0.04 mm wide near base, forewing 3 mm long, cornicle including margin 0.06 mm in diameter at apex, cauda including basal part 0.092 mm long, anal plate 0.135 mm wide, hind tibia 1.4 mm long, 0.051 to 0.055 mm wide about middle, hind tarsus 0.15 mm long.

Host.—*Arundinaria* sp., attacking the lower side of leaf.

Habitat.—Taiheizan (Mount Taihei), Mururoafu, Shin-Taiheizan.

Some specimens were collected by me in September, 1938 and 1939. This species is the second member of the genus *Shivaphis* Das, and differs from *S. celti* Das in the coloration, the larger cornicles, the head not indented at middle of front and without wax pores, frontal tubercles more developed, antennæ without discernible wax pores, antennal segment three with sensoria near base, legs longer, and in other respects. Very scarse, occurring in small numbers.

Arundinaria is very abundant on high elevation in Formosa, and seven species of aphids are now known to attack it at high altitudes in the island, namely, *Cranaphis formosanus* Takahashi, *Myzocallis arundinariæ* Essig, *Shivaphis arundinariæ* sp. nov., *Aphis arundinariæ* Takahashi, *Cerataphis bambusifoliæ* Takahashi, *Ceratovacuna arundinariæ* Takahashi, and *Oregma tattakana* Takahashi, of which *Myzocallis arundinariæ* Essig and *Cerataphis bambusifoliæ* Takahashi occur also in the lowlands.

CERATOVACUNA BREVICORNIS sp. nov.

Wingless viviparous female.—Brownish pink, densely covered with wax, which forms tassels along margin. Body without granules on dorsum. Head thickened on derm of anterior part, with about 15 very long, fine setæ on frontal area, these setæ about 1½ times as long as antennal segment one; a pair of similar setæ present between dorsal groups of wax pores and postlaterad of these groups; over 10 similar setæ on anterior part of venter, of which a foremost pair is longer. Frontal horns very small, triangular, often much wider than

FIG. 5. *Ceratovacuna brevicornis* sp. nov.; winged viviparous female. Head and prothorax.

long, pointed apically, much shorter than second antennal segment, variable in length. Eyes composed of three facets, a little protruding. Cephaloprothorax much wider than long, a little constricted at hind part. Antennæ shorter than width of prothorax, but longer than space between them, slightly shorter than fore tibiæ, 4-segmented; segment three narrowed on basal part, slightly or scarcely imbricated, about $1\frac{1}{2}$ times as long as segment four, with a few short setæ; segment four narrowed basally. Rostrum not reaching fore coxæ; distal segment a little longer than wide, blunt at apex, with two pairs of long bristles about middle and a pair of much shorter, stiff, distal bristles. Meso- and metanotum and basal six abdominal segments each with 4 long, fine setæ in a row; abdominal segment seven with a pair of similar setæ on median area; these setæ as long as those on head. Abdomen broadest on segment three, segments three to five fused. Cornicles rather large in diameter, not on sclerotised parts, much larger than wax pores, slightly but distinctly separated from the lateral groups of wax pores, not surrounded with setæ. Cauda constricted basally, much wider than long, about twice as wide as diameter of cornicles, with about 15 setæ. Anal plate divided, lobes narrower than cauda, with about 6 setæ. Trochanters not defined from femora; femora with some long, fine setæ, which are shorter than width of femora; tibiæ stouter than third antennal segment, with some fine setæ; tarsi as long as last antennal segment, a little imbricated; fore tarsi with 2 stiff median and 2 much longer lateral setæ on basal segment; middle and hind tarsi with 2 long setæ on basal segment; tarsal digitules very long, slightly capitate. Ventral setæ of abdomen shorter, but more in number than dorsal setæ, not in rows. Wax pores well developed, large, well defined except for those on head, present in a large group on each side of each of thoracic and basal seven abdominal segments, in a large median group on abdominal segment eight, and in a pair of smaller groups on dorsum of head, thorax, and basal abdominal segment; each group of wax pores on a sclerotised area; each lateral group with a long seta, median group on abdominal segment eight with 2 long setæ closely placed; numbers of wax pores in each group about as follows: Lateral group: prothorax, 7 to 9; mesothorax, 6 or 7; metathorax, 7 or 8; abdominal segment one, 6 or 7; abdominal segment two, 9 or 10; abdominal segment three, 10 to 13; abdominal segment four, 10 or 11; abdominal segment five, 11 to 13; abdominal segment six, 13 to 15; abdominal segment seven, 17.

Dorsal group: head, 7 or 8; prothorax, 1; mesothorax, 1 to 3; metathorax, 1 or 2; abdominal segment one, 1 or 2; abdominal segment eight, 24 to 28. Body about 1.5 to 1.8 mm long.

Host.—*Bambusa* sp., attacking the lower side of leaf at some distance from the apex.

Habitat.—Suisha, Taichu Prefecture.

Many specimens were taken by me August 4, 1939. This species is characterized by the minute horns on the front, and by the presence of dorsal wax pores on the thorax and the basal abdominal segment. The nymph of the first instar possesses long slender horns on the front, which are longer than the basal two antennal segments taken together and parallel, and the anterior femora not expanded. In *Ceratovacuna longifila* Takahashi, horns on the front longer, setæ in the group of wax pores on abdominal segment eight very far separated, thorax and basal abdominal segment lacking dorsal wax pores.

This new aphid has the very peculiar habit of grouping very densely on the lower side of the leaf at some distance from the apex.

The materials upon which the present paper is based are deposited in the author's collection.

ILLUSTRATIONS

TEXT FIGURES

FIG. 1. *Stomaphis yanonis* Takahashi. Wingless viviparous female; antenna.

2. *Paratrichosiphum niidakaense* Takahashi. a, winged viviparous female, head; *b*, winged viviparous female, basal part of antennal segment three; *c*, wingless viviparous female, cornicle with hairs removed.

3. *Eutrichosiphum elongatum* sp. nov. Wingless viviparous female; cornicle.

4. *Shivaphis arundinariæ* sp. nov. Winged viviparous female. *a*, last antennal segment; *b*, cauda; *c*, anal plate with hairs removed; *d*, basal part of third antennal segment; *e*, forewing; *f*, head.

5. *Ceratovacuna brevicornis* sp. nov. Winged viviparous female; head and prothorax.

MORPHOLOGICAL STUDIES ON VARIOUS PHILIPPINE HETEROPHYID METACERCARIÆ WITH NOTES ON THE INCIDENCE, SITE, AND DEGREE OF METACERCARIAL INFECTION IN THREE SPECIES OF MARINE FISH.[1]

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TWO PLATES

Simultaneously with the systematic examination of fish for metacercariæ as a preliminary step in selecting material for feeding experiments to determine the piscine intermediate hosts of Philippine heterophyid trematodes,(9, 10) we have undertaken a study on the morphology of the metacercariæ found in every species of fish that we have experimented with, in order to correlate, verify, and integrate our findings. We have also determined the incidence, site, and degree of metacercarial infection in three species of marine fish.

Close scrutiny of the metacercariæ obtained from the various fish used in our feeding experiments proved invaluable for orientation purposes in checking up the results of the experiments. Thus we soon discovered that not all of the species of metacercariæ obtained from a given fish and fed to a given animal develop and mature in the latter. This finding suggested the necessity of diversification of the experimental hosts. Incidentally, Ciurea(5) classifies hosts into three categories; namely, favorable, unfavorable, and refractory: favorable hosts being those in which the parasite can become ovigerous; unfavorable, those in which the parasite cannot become ovigerous; and refractory animals, those in which the parasite cannot develop at all. Comparison of the adult heterophyids recovered in our feeding experiments with the homologous metacercariæ harbored by the species of fish which furnished the metacercariæ used in

[1] Aided by a special research grant from the Board of Regents, University of the Philippines.

the feeding experiments enabled us to verify that these trematode larvæ, except for sexual immaturity, are exact miniatures of their adults. Hence, by identifying the metacercariæ in a given species of fish, it is possible to tell the species of trematodes of which it is the second intermediate host.

A description of seven species of metacercariæ studied by us, and an account of the incidence, site, and degree of metacercarial infection in three species of marine fish that furnished some of the metacercarial species studied, will be the subject of this report. The metacercariæ herein described are the following: *Stictodora guerreroi, Stictodora manilensis, Haplorchis calderoni, Haplorchis sisoni, Haplorchis yokogawai, Stellantchasmus falcatus* (=*Diorchitrema pseudocirrata*), and *Stamnosoma formosanum*. The three species of fish studied as to incidence, site, and degree of metacercarial infection are *Hepsetia balabacensis* Jordan and Hubbs, *Hemiramphus georgi* Cuvier and Valenciennes, and *Ambassis buruensis* Bleeker.

TECHNIC

The fish to be dissected was carefully washed in tapwater several times, the whole, or a part, of it, according to the site selected for study, placed in a small Petri dish, and a little salt solution added. Under a dissecting microscope, by means of teasing needles, the metacercariæ were dissected away from the tissues, fished out by means of a fine pipette provided with a rubber nipple, placed in a drop of salt solution, on a clean slide, covered with a thin cover glass, and examined under the compound microscope, under low and high powers. The sites from which the metacercariæ were obtained were carefully noted down, measurements were taken with the ocular micrometer, sketches made of the metacercariæ, and all observations written down right by the microscope. Precautions were taken against drying of the smears by adding salt solution from time to time, or by vaselining the edges of the cover glass. Whenever it was desired to excyst the metacercariæ herein described, gentle tapping of the cover glass generally sufficed to effect their excystment. The liberated metacercariæ were studied in the fresh state, sometimes tinged with eosin alcohol. In counting the metacercariæ a fine pipette provided with a rubber nipple was used for picking them up and transferring them from one container to another.

RESULTS

The metacercaria of Stictodora guerreroi Garcia and Refuerzo, 1936[6] (Plate 1, figs. 1 and 2)

By feeding experiments[9,10] we have determined that this metacercaria is harbored by *Hepsetia balabacensis* Jordan and Hubbs, *Hemiramphus georgi* Cuvier and Valenciennes, *Ambassis buruensis* Bleeker, and *Mugil dussumieri* Cuvier and Valenciennes. By actual dissection we have ascertained its parasitization in various sites of the body of the above fish. We have dissected it from the interradial tissue of the caudal fin, flesh, abdominal cavity, aorta, heart, muscles of the eye ball, and soft tissues of the jaws of *Hepsetia balabacensis;* from the flesh, abdominal cavity, aorta, and heart of *Ambassis buruensis;* and from the interradial tissue of the caudal fin, flesh, abdominal cavity, aorta, and heart of *Hemiramphus georgi.* In the abdominal cavity of these fish they occur free or more or less loosely attached to the viscera. Not infrequently they surround the heart and aorta, quite firmly attached to the latter, and sometimes they are actually embedded in the heart muscle. In *Hepsetia balabacensis* this localization in the vicinity of the heart seems actually to amount to a predilection, so much so, that the heart alone may show as few as two metacercariæ snuggly nestling in its pericardium after minute dissection of the rest of the fish's body has failed to show the metacercariæ elsewhere. In the flesh they are always more abundant near the caudal fin. They are easily dissected away from the tissues, to which they are not firmly attached. To the naked eye they appear as tiny, opalescent-white, ellipsoidal or rounded grains, which under the dissecting microscope show as tiny, biconvex, transparent cysts harboring a blackish-brownish, actively moving, coiled-up, or only slightly curved or bent, larva which more or less completely fills up the cyst cavity. The anterior portion of the worm is brownish and its posterior half is blackish. Under the low power of the compound microscope the cyst wall is thin, hyaline, transparent. Except in very young metacercariæ, which lie straight, the larva is found flexed upon its ventral aspect within the cyst. It is oblong in shape and moves briskly, turning around the center of the cyst sidewise or headwise. Particles and spherules of various sizes in varying numbers are present in the liquid bathing the larva within the cyst cavity. In a good specimen, with the larva favorably posed and vision unmolested by these particles, all the organs of the encysted worm can be

distinguished, and the trematode specifically identified, even under low power, as *S. guerreroi*, the gonotyl armature standing out conspicuously as a tiny, blackish horseshoe at a point about the middle of the body of the worm. Cuticular spines are present, except at the posterior pole. They are quite prominent and abundant at the anterior half of the body of the worm, and diminish gradually in size and number as the posterior pole is reached. At the anterior extremity of the worm is seen the oral sucker subterminally placed and giving rise to a rather long prepharynx which leads into an ellipsoidal pharynx. The œsophagus, not quite as long as the prepharynx, arises from the pharynx and bifurcates into two slender cæca which, following the lateral portions of the body, proceed posteriorly to where they end blindly, one on either side of the excretory vesicle near the posterior extremity of the body. The excretory vesicle has the form of a Y, the two arms of which are prolonged anteriorly, one on either side of the body, to the base of the oral sucker. In the third fourth portion of the body of the larva, in the space enclosed by the arms of the excretory vesicle and the cæca, are contained the anlage of the ventrogenital sac, the testes, ovary, and receptaculum seminis. The testes are obliquely placed, the right being the more posterior. Immediately anterior to the right testis is the anlage of the ovary, and close to the right testis, between it and the left testis, is seen the tiny anlage of the receptaculum seminis. From the anterior borders of the testes two fine tubes, one for each testis, arise and unite anteriorly to form a single tube which widens out into a small sausagelike organ, the anlage of the seminal vesicle, which ends in the anlage of the ventrogenital sac, a pyriform organ situated about the middle of the body of the larva, at the point where the worm lies bent on itself. The ventrogenital sac bears a conspicuous, incomplete circle of thickly-set spines, which, being nearly as well developed as those found on the gonotyl of the adult, make it possible to identify the species of the metacercaria as *Stictodora guerreroi*. Fine spherules fill the digestive tract and excretory vesicle, and are constantly being discharged from the oral sucker and the excretory pore into the liquid bathing the larva within the cyst. Brownish pigment granules are scattered under the cuticle throughout the body, especially at the anterior portion, and in young metacercariæ conspicuous brownish to blackish eye spots are seen on the prepharynx, generally one on either side. Flame cells, visible with the oil immersion lens,

are distributed symmetrically throughout the body of the larva. By high power the anlage of the uterus is detectable in the form of a transparent tubule visible between and behind the testes, while the anlage of the metraterm is recognizable in the form of a transparent, delicate tube leading to the ventrogenital sac anlage.

The size of the fresh cysts, as determined from metacercariæ dissected from various body sites of the fish mentioned above, ranges from 0.206 to 0.612 mm in length and from 0.149 to 0.527 mm in width. The thickness of the cyst wall averages 0.0027 mm. The excysted metacercariæ range from 0.548 to 1.295 mm in length and from 0.142 to 0.498 mm in width. The various organ anlage gave the following measurements: the oral sucker, 0.053 to 0.071 mm longitudinally by 0.062 to 0.085 mm transversely, averaging 0.061 by 0.074 mm; the prepharynx, 0.081 to 0.146 mm by 0.007 to 0.014 mm, average 0.113 by 0.01 mm; the pharynx, 0.05 to 0.057 mm long by 0.04 to 0.05 mm wide, or 0.052 by 0.044 mm; the œsophagus, 0.053 to 0.128 mm long by 0.008 to 0.021 mm wide, or 0.091 by 0.015 mm; the ventrogenital sac, 0.057 to 0.083 mm longitudinally by 0.06 to 0.1 mm transversely, or an average of 0.073 by 0.08 mm, the longest spines on the gonotyl measuring 0.013 mm; the right testis, 0.071 to 0.085 mm longitudinally by 0.071 to 0.1 mm transversely, or 0.08 by 0.088 mm; the left testes, 0.06 to 0.078 mm longitudinally by 0.071 to 0.1 mm transversely, or 0.07 by 0.082 mm; the ovary, 0.03 to 0.05 mm longitudinally by 0.03 to 0.043 mm transversely, or 0.041 by 0.038 mm; the seminal receptacle, 0.043 mm in diameter.

The metacercaria of Stictodora manilensis Africa and Garcia, 1935[2] (Plate 1, figs. 3 and 4)

By feeding experiments[9, 10] we know that *Hepsetia balabacensis* Jordan and Hubbs, *Ambassis buruensis* Bleeker, *Mugil dussumieri* Cuvier and Valenciennes, *Therapon plumbeus* (Kner), *Gerris filamentosus* Cuvier and Valenciennes, *Pelates quadrilineatus* (Bloch), and *Therapon jarbua* (Forskål) (results with last-named fish not yet published) harbor the metacercariæ of *Stictodora manilensis.* By actual dissection we have found the metacercariæ in the caudal fin, flesh, and abdominal cavity of *Ambassis buruensis* and *Hepsetia balabacensis,* and in the abdominal cavity of *Mugil dussumieri* and *Gerris filamentosus.* In the caudal fin they are found in the interradial tissue. As many as 15 metacercariæ were found in the caudal fin of one tiny

Hepsetia balabacensis 6 cm long. In the abdominal cavity they occur free or loosely attached to the surface of the viscera. In the region of the heart they are found free by it, or attached to the aorta, or actually embedded in the heart muscle. They are easily dissected away from the tissues which apparently show no reaction to the presence of the parasite.

With the exception of the spiny armature and the rudimentary ventral sucker of the ventrogenital sac, the anatomical description given above of the metacercaria of *Stictodora guerreroi* applies equally well to that of *Stictodora manilensis*. We shall, therefore, limit ourselves to describing the gonotyl garnishings and its rudimentary ventral sucker. The smaller (left) portion of the transversely placed, ovoid ventrogenital sac is occupied by a fanlike figure formed by 15 to 17 spines not unlike the hooklets garnishing the rostellum of *Dipylidium caninum*, the wider portions of the spines being attached, while the narrower, free, ends converge at the left end of the ventrogenital sac to form the vertex of the fanlike figure formed by the spines. The attached bases of the spines are apparently implanted on one and the same tissue stratum, on a common level. Just how many rows the spines form on this common basic stratum could not be determined, but it seems that they do not form a linear row, but rather a zigzagging row, alternating or overlapping of the spines being apparent at their insertions. They partly encircle and hide from view a tiny, button-hole-like structure, which is apparently the rudimentary ventral sucker described in the adult by Africa and Garcia.(2) The conspicuous fanlike figure formed by the spines of the gonotyl, by which the metacercariæ are identified, is visible, even under low power, at a point below the transverse middle level of the body of the larva.

Measurements taken on fresh metacercariæ of *S. manilensis* obtained from various body sites of various species of fish gave the following figures: The cysts range from 0.199 to 0.484 mm in length, and from 0.142 to 0.420 mm in width; the ventrogenital sac varies from 0.03552 to 0.04588 mm transversely and from 0.0296 to 0.03404 mm longitudinally; the hyaline cyst wall ranges from 0.00111 to 0.00373 mm in thickness, the average thickness being 0.002759 mm; the longest spines on the gonotyl range from 0.0074 to 0.01184 mm in length; the rudimentary ventral sucker measures 0.014985 mm transversely and 0.011655 mm longitudinally; the oral sucker 0.068 and 0.062 mm in the transverse and longitudinal directions, respectively; the pharynx

0.03996 mm transversely and 0.04588 mm longitudinally; the particles floating in the cyst fluid vary from very minute to 0.011665 to 0.01665 mm. When the fresh cysts are treated with eosin alcohol, the large particles appear as pink, opaque, homogeneous masses, while the majority of the small particles are bright and nonstaining. The excysted metacercariæ vary in length; one measured in the quiescent state was 0.797 mm long and 0.342 mm across.

THE METACERCARIA OF HAPLORCHIS CALDERONI AFRICA, 1938[1] (PLATE 1, FIGS. 5 AND 6)

Feeding experiments[9, 10] have demonstrated that *Hepsetia balabacensis* Jordan and Hubbs, *Hemiramphus georgi* Cuvier and Valenciennes, *Ambassis buruensis* Bleeker, *Mugil dussumieri* Cuvier and Valenciennes, *Ophicephalus striatus* Bloch, *Glossogobius giurus* Buchanan-Hamilton, *Gerris filamentosus* Cuvier and Valenciennes, *Creisson validus* Jordan and Seale, *Anabas testudineus* (Bloch), *Pelates quadrilineatus* (Bloch), *Teuthis javus* (Linnæus), and *Eleutheronema tetradactyla* (Shaw) are piscine intermediate hosts of *Haplorchis calderoni*. For the study of the metacercariæ dissections were made of three of the above-listed fishes; namely, *Hepsetia balabacensis*, *Anabas testudineus*, and *Creisson validus*. These three fishes showed the metacercariæ in the flesh, and *Creisson validus* also showed them in the soft tissues between the gills.

To the naked eye the metacercariæ appear as very tiny whitish grains which under low power show as biconvex, thin, transparent cysts completely filled up by a light-brownish, actively whirling larva which bristles with scalelike spines arranged in quinqunx over the anterior three-fourths of its cuticle, is bent upon its ventral aspect, and is partly hidden by a conspicuously black material occupying a great part of its posterior portion. This black material, abounding in spherules, actually fills the globular, greatly distended excretory tube. The intestinal cæca, filled up with a single rouleau of transparent, uniformly-sized discs which move up and down, and back and forth, rhythmically with the contractions of the larva, at once engage the attention of the examiner. To identify the parasites it is necessary to examine them when they excyst, which they do spontaneously some time after they have lain underneath a thin cover glass. The excysted larva is pyriform, widest posteriorly. It moves actively, and its banana-shaped longitudinally striated expulser is conspicuous, situated obliquely to the left of the median line

in the middle third of the body. The single, large, globular testis is centrally located in the posterior third of the body. Anterior to the testis, to the right of the median plane, are the roundish ovary and seminal receptacle, the latter occupying an intervening position between the testis and ovary. The greatly distended, Y-shaped excretory tube occupies a blackish semilunar space enclosing the posterior border of the testis in the extreme posterior portion of the body. Spherules from the blackish material filling the excretory tube are continually being discharged from the excretory pore. Anteriorly the expulsor is narrowed into the tubular ejaculatory duct, which, in common with the denticulated metraterm with which it unites, ends right by the smaller pole of a small, richly cellular, pear-shaped body situated obliquely mesially or a little to the right of the median plane, at the junction of the anterior and middle thirds of the body of the trematode, the smaller pole of this pear-shaped body being directed obliquely posteriorly. This pear-shaped body is the anlage of the ventrogenital sac, and it is its smaller pole that must be scrutinized in order to establish the identity of the metacercaria. In *Haplorchis calderoni* the surface of this pole is studded with a few, very minute, rudimentary prickles. The oral sucker is anterosubterminal, the prepharynx short, the pharynx globular, and the œsophagus capillary and bifurcating anterior to the ventrogenital sac into two cæca which extend laterally on either side of the body and end blindly at the level of the posterior border of the testis.

The fresh metacercariæ (cysts) vary in length from 0.189 to 0.27 mm, and in width from 0.142 to 0.206 mm. The hyaline cyst wall is 0.00111 to 0.00222 mm thick. The liberated (excysted) metacercariæ range from 0.285 to 0.569 mm in length and vary in width from 0.142 to 0.27 mm. Transversely the oral sucker measures 0.033 to 0.06 mm; and longitudinally it varies from 0.033 to 0.43 mm. The pharynx is 0.033 mm long and 0.27 mm across. The intestinal cæca vary from 0.083 to 0.1 mm in length. The discs contained in the intestine have a diameter of 0.01665 mm. The ventrogenital sac measures 0.018 by 0.015 mm. The testis has a transverse diameter which varies from 0.06 to 0.093 mm and a longitudinal diameter ranging from 0.047 to 0.06 mm. The length of the expulsor oscillates between 0.057 and 0.08 mm. The eye spots measure 0.005 mm transversely and 0.003 mm longitudinally. One of the cuticular spines on the anterior portion of the larva was

also measured; it had a width of 0.007 mm and a length of 0.005 mm.

THE METACERCARIA OF HAPLORCHIS SISONI AFRICA, 1938(1) (PLATE 2, FIGS. 1 AND 2)

The metacercariæ of this experimental heterophyid(10) recently described by one of us (C. M. A.) (1) parasitize the interradial tissue of the caudal fin and the flesh of a fresh-water fish named *Therapon plumbeus* (Kner)[2], locally known as *ayuñgin*.

Under the dissecting microscope these metacercariæ are very minute, whitish, ellipsoidal grains easily dissected away from the tissues in which they are found encysted. The cyst membrane is thin and transparent, and the contained larva, which is bent upon itself, moves briskly, and shows a large, blackish, roundish portion standing in high contrast with a smaller, light-colored, semilunar portion. Under the low power of the compound microscope the black mass is observed to be the excretory vesicle, which is filled with numerous refractile spherules and hides from view the other organs contained in the posterior half of the bent larva. The lighter-colored, semilunar portion is the anterior half of the parasite, which shows well the cuticular spines, the oral sucker, prepharynx, pharynx, œsophagus, and part of the intestinal cæca. The cyst fluid contains conspicuous, oval, translucent, thin bodies of uniform size, which are discharged from the alimentary canal through the oral sucker. In the digestive tract of the larva these bodies are discoidal and apparently slightly compressible, and align themselves in a single rouleau which completely fills the lumen of the tract. Rhythmical contractions of the digestive tube shove them out into the cyst cavity, where they take on an oval outline. When the cyst wall breaks, the discs resume the circular outline and manifest a tendency to cupping, in much the same fashion as erythrocytes do. Ciurea (5, pp. 68, 74, 80) has observed similar discs in the intestinal cæca of the metacercariæ of *Pygidiopsis genata, Metascocotyle witenbergi* [=*Parascocotyle* (Ransom)] and *Ascocotyle cœlostoma,* and states that he does not know what they mean. We find ourselves in the same predicament. With regard to the spherules contained in the excretory vesicle Ciurea(5) writes that they are made up of calcium carbonate.

[2] Due to an error this fish was noted down as *Therapon argenteus* in the above-mentioned description of *Haplorchis sisoni* (C. M. A.). (1)

The cysts are indistinguishable from those of the metacercariæ of *Haplorchis calderoni*, and it is only after excystment that the larvæ may be identified. They are spontaneously liberated under the slight pressure exerted by a thin cover glass upon them. The excysted pyriform larva moves actively and shows numerous, scalelike, cuticular spines arranged in quincunx, which gradually become less and less conspicuous and finally disappear towards the posterior end of the parasite. The organs contained in the posterior half of the larva are pushed anteriorly by the greatly distended excretory vesicle forming a large, black, semilunar pouch filled with spherules and occupying the posterior fourth of the body of the trematode, where it encroaches upon the testis and partly hides it from view. In this state of distention of the excretory vesicle the ventrogenital sac occupies the center of the body of the worm. It is a transversely ovoid organ, bearing at its smaller pole a very tiny, planoconvex, prickly appendage, the gonotyl, thickly set with very minute, conical spines on its free, convex surface, and attached sessile by its plane surface to the sustaining, ovoid structure just mentioned. In the adult experimental heterophyid recovered from animals fed with this metacercaria, the ventrogenital sac is a thick-walled, saclike organ placed deeply in the body, opening on the ventral surface, and bearing at its brim the tiny, prickly appendage, the gonotyl, described above. A conspicuous, pyriform muscular expulsor, showing longitudinal striations enclosed within a thick, hyaline wall, tapers anteriorly and mesially into a narrow ejaculatory tube that, uniting with the tubular anlage of the metraterm, forms the common genital duct and ends underneath the prickly armature of the gonotyl. It resembles the expulsor of *Haplorchis calderoni*, but is much smaller. Like it, it follows the curve of the left intestine and occupies a position between the latter and the ovary. The metraterm, like that of *Haplorchis calderoni*, shows denticulations on its inner surface. The round ovary occupies a position between the expulsor on the left and the intestinal ramus on the right, with the mesially placed, single, spherical testis posterior to it, and the ventrogenital sac anterior. The anlage of the seminal receptacle is sometimes discernible as a tiny, delicate, roundish structure on the right side of the body between the ovary and testis. The digestive tract has its origin in an anterosubterminally placed oral sucker giving rise to a short prepharynx that leads into a thick pharynx, from which arises

a filiform œsophagus which, anterior to the ventrogenital sac, bifurcates into two cæca that, proceeding laterally and posteriorly, end blindly not farther than the middle transverse level of the testis. Within the intestinal cæca and œsophagus are contained the conspicuous, transparent discs mentioned above, closely packed at some points or only overlapping at others, like a series of coins in a single rouleau filling the lumen of the gut. As stated above in the course of this description, these discs are apparently compressible, for, when closely packed, they seem to be slightly thinner than when loosely packed. They are discharged at intervals through the oral sucker, and seem to be quite elastic and resistant. We have never observed them to break up.

The metacercariæ (cysts) range from 0.174 to 0.299 mm in length, and from 0.107 to 0.192 mm in width. The cyst wall, which consists of a hyaline substance, varies from 0.00111 to 0.00296 mm. The discs contained in the digestive tract range from 0.01332 to 0.01832 mm in diameter, and have a thickness of 0.00333 mm. Those observed by Ciurea(5) in the metacercariæ of *Pygidiopsis genata* varied from 0.013 to 0.017 mm in diameter, with a thickness of 0.004 mm. The excysted metacercariæ (quiescent) vary from 0.342 to 0.614 mm in length, and from 0.16 to 0.242 mm in width. The oral sucker measures 0.044 to 0.058 mm longitudinally, and 0.053 to 0.055 mm transversely. The prepharynx is 0.03 mm long and 0.003 mm wide. The pharynx measures 0.031 mm transversely and 0.028 to 0.03 mm longitudinally. The œsophagus is 0.121 mm long. The ventrogenital sac, exclusive of the gonotyl, has a transverse diameter of 0.025 mm and a longitudinal diameter of 0.019 mm. The gonotyl ranges from 0.009 to 0.010 mm in diameter. The expulsor has a length of 0.05 to 0.074 mm, and in width varies from 0.024 to 0.025 mm, its hyaline, nonstriated, external layer having a thickness of 0.003 mm. The ejaculatory duct is 0.03 mm long and 0.003 to 0.006 mm across.

The metacercaria of Haplorchis yokogawai (Katsuta, 1332)(7) (Plate 2, figs. 3 and 4)

From the results of feeding experiments(9,10) we know that *Hemiramphus georgi* Cuvier and Valenciennes, *Ambassis buruensis* Bleeker, *Mugil dussumieri* Cuvier and Valenciennes, *Clarias batrachus* (Linnæus), *Arius manillensis* Cuvier and Valenciennes, *Ophicephalus striatus* Bloch, and *Gerris kapas* Bleeker are piscine intermediate hosts of *Haplorchis yokogawai*. For

the study of the metacercariæ of this trematode material was obtained from the flesh of *Arius manillensis*, in which they are often found in great numbers.

Under the dissecting microscope the metacercariæ make their appearance on the bottom of the dissecting dish, where the flesh of the fish is being teased out, as tiny, ellipsoidal, grayish bodies completely filled up by an actively moving, coiled up, light-brownish larva. They are apparently very loosely attached to the muscle tissue, for, when first sighted, they have already gained the bottom of the dissecting dish. They evidently drop from the tissues with the greatest facility. To the naked eye they are indistinguishable from the flesh of the fish, but isolated, the metacercaria is visibe as a very minute whitish grain. An idea of its abundance in the flesh of this fish is furnished by the following observation: from a block of its flesh measuring only 3.87 cc, 57 metacercariæ of *Haplorchis yokogawai* and 5 of another species were obtained. Under low power the round, blackish mass formed by the distended excretory tube stands out in contrast with the light-brownish coloration of the rest of the larva's body, the worm being flexed upon itself ventrally and almost, or quite, completely filling up the cyst cavity, wherein it whirls more or less actively. Its cuticle is covered with spines, and highly refractive, yellowish-greenish droplets discharged from the excretory tube surround the worm. By high power, at a point anterior to, and close by, the black mass formed by the excretory tube, is clearly seen the typical gonotyl of *Haplorchis yokogawai* garnished with tiny spines and two conspicuous plates, quite as described by Chen(4) for the adult. Even metacercariæ so young as to still exhibit the eye spots show the characteristic gonotyl plates in the center of the body of the young trematode posterior to the eye spots. The cyst wall is made up of a thin layer of a hyaline substance, which, under gentle pressure, ruptures and allows the contained larva to escape. The excysted worm is oblong or pyriform, and scalelike spines arranged in quinqunx cover its body, except at the posterior pole, while scattered throughout in its tissue, especially around the œsophagus and its bifurcation, are seen pigment granules. The oral sucker is anterosubterminal, the pharynx globular, and the œsophagus, which is about twice as long as the prepharynx, bifurcates at the middle of the body into two cæca, each of which, running laterally, gradually widens out, and comes to a blind end beyond the posterior border of the testis, on either side of the more or less distended excretory tube, the two cæca

enclosing together with the latter the conspicuous ventrogenital complex situated obliquely behind the bifurcation of the œsophagus and the receptaculum seminis, the ovary, and the single testis grouped behind it, the ovary and receptaculum seminis occupying an intervening position between the ventrogenital complex and the testis. The cæca are closely packed with discs not unlike those found in other metacercariæ and described elsewhere in this paper. The ventrogenital complex comprises two portions; one, a larger, colorless, more or less globular, nonspiny body; and the other, a smaller, spiny, more or less heart-shaped structure, which, as a shield, overlaps the mesial pole of the nonspiny, globular integrant. The spiny portion, the gonotyl, is occupied by two very conspicuous, chitinous, more or less serrated plates, which are surrounded by numerous, very minute spines, or prickles, the plates taking a more or less eccentric position in this clearly delimited, spiny constituent. The plates are 0.00592 to 0.00814 mm long and 0.00222 to 0.00296 mm wide, and, at their very root, where they are inserted side by side into the body tissue, they are only 0.00148 mm apart. They are chitinous, concave structures with irregularly serrated, incurving edges, the concavity being directed ventrad. Not infrequently one of the plates is actually made up of several curved pieces. The plates occupy an area of 0.0088 mm in diameter, the total area covered by them and the surrounding minute spines, the gonotyl, measuring 0.01776 by 0.02368 mm. The transverse diameter of the ventrogenital complex is 0.04462 mm long and its longitudinal diameter 0.0333 mm long. The organ is located at the junction of the middle and posterior thirds of the body. The testis measures 0.04995 mm transversely and 0.03663 mm longitudinally, and the ovary is 0.02331 and 0.02664 mm in the same, respective, directions. The receptaculum seminis is about the size of the ovary. The intestinal cæca measure 0.173 mm in length, their width at the œsophageal bifurcation being 0.0066 mm and at the posterior end, 0.01332 mm. The œsophagus measures 0.08658 by 0.00666 mm, the pharynx 0.04329 by 0.03663 mm, the prepharynx is 0.0333 mm long, and the oral sucker 0.0666 and 0.07326 mm in its longitudinal and transverse diameters, respectively. The excysted larva is 0.427 mm long and 0.185 mm wide. The cysts vary from 0.142 to 0.277 mm in length, and from 0.114 to 0.249 mm in width. The cyst wall has a thickness of 0.000832 to 0.001385 mm.

THE METACERCARIA OF STELLANTCHASMUS FALCATUS ONJI AND NISHIO, 1924 (=DIORCHITREMA PSEUDOCIRRATA) (PLATE 2, FIGS. 5 AND 6)

Diorchitrema pseudocirrata Witenberg, 1929(11) is, according to Alicata and Schattenburg,(3) synonymous with *Stellantchasmus falcatus* Onji and Nishio, 1924. Doctor Alicata saw our material and compared it with his specimens of *Stellantchasmus falcatus*, which he recovered from a Japanese in Hawaii, and he declared that the two materials are identical. Doctor Price, of the Bureau of Animal Industry, Washington, D. C., who also saw our specimens, holds the same opinion. By right of priority *Stellantchasmus falcatus* should be the valid name of this species.

By feeding experiments(9, 10) we have found that *Mugil dussumieri* Cuvier and Valenciennes and *Anabas testudineus* (Bloch) are piscine intermediate hosts of *Stellantchasmus falcatus*. Dissections of the entire body of *Mugil dussumieri* have revealed that the metarcercariæ parasitize the flesh and the body cavity (in the vicinity of the heart) of this fish. The cysts are only loosely attached to the flesh, and to the naked eye they appear as very tiny whitish grains. Under the dissecting microscope the ellipsoidal, transparent cyst shows a minute, oblong, actively whirling, light-brownish larva which is covered with small cuticular spines and is slightly bent upon its ventral aspect, almost completely filling the cyst cavity. Under the low power of the compound microscope it is easily recognized by the obliquely placed, more or less elongated, pyriform expulsor situated alongside the curve of the left intestine, the round ovary opposite to the expulsor, and the two globular testes behind them, one on either side and on the same transverse level, in the posterior portion of the body. Blackish liquid rich in spherules fills the distended and conspicuous excretory tube between the testes, and is discharged from the excretory pore into the fluid of the cyst cavity. Under high power the expulsor shows spiral fibers enclosed within a thick, transparent wall. Anteriorly it narrows into a short ejaculatory duct which leads into a transparent, globular structure, the ventrogenital sac, situated behind the bifurcation of the œsophagus, lateral to the mesial plane, on the opposite side at the junction of the middle and posterior thirds of the body. Within this globular structure is clearly visible the ventral sucker apposed to an external aperture which is surrounded by very minute, rudimentary, hairlike spines, the whole structure describing a conspicuous, horseshoe-shaped figure. Neither in these metacercariæ nor in their expe-

rimentally recovered adults have we been able to detect the mass of prostatic cells described by Witenberg as surrounding the junction of the uterus and ejaculatory duct in specimens of *Diorchitrema pseudocirrata.* Connecting with the posterior end of the expulsor by a constriction is a more or less globular structure, the first portion of the seminal vesicle. The oral sucker is situated anterosubterminally, the prepharynx is short, and the pharynx is more or less globular. The œsophagus, about twice as long as the prepharynx, bifurcates in the middle portion of the body into two cæca which run laterally on either side and end blindly at the anterior border of the testis. Discs like those seen in the digestive tube of *Haplorchis calderoni* and *Haplorchis sisoni* metacercariæ fill up the intestinal cæca. The arms of the excretory tube are continued anteriorly on either side of the body as blackish, fine, tortuous tubes extending up to the oral sucker.

The metacercariæ (cysts) range from 0.135 to 0.142 mm in length, and from 0.133 to 0.391 mm in width. The cyst wall varies from 0.0016 to 0.0022 mm. The excysted metacercaria, when quiescent, is 0.583 to 0.598 mm long and 0.171 to 0.299 mm across. The oral sucker measures 0.0725 mm transversely and 0.0636 mm longitudinally. The prepharynx is 0.0013 mm long. The pharynx measures 0.004 mm longitudinally and 0.0039 mm transversely. The œsophagus has a length of 0.085 mm.

The metacercaria of Stamnosoma formosanum Nishigori, 1924[8] (Plate 2, figs. 7 and 8)

In our first paper on the determination of the piscine intermediate hosts of Philippine heterophyid trematodes by feeding experiments[9] we made the following remarks in connection with Centrocestinæ:

> In one of the species of fish (*Ambassis buruensis*) utilized in these experiments we have frequently found two apparently different species of *Stamnosoma* (one big and having a long intestine, and the other very tiny and having a short intestine) ..... in their metacercarial stage. The larger of the two *Stamnosoma* metacercariæ also parasitizes *Hepsetia balabacensis*, another fish used in these experiments. Up to this time, however, we have consistently failed to recover these Centrocestinæ by experimental feeding to albino rats and mice, kittens, and puppies. One of us (C. M. A.) recovered an apparently new species of *Stamnosoma* from the intestine of a pelican (*Pyrreroides manilensis*) and from the cattle egret.

In the succeeding progress report[10] we reported, among other findings, on the experimental recovery of *Stamnosoma formosa-*

num by means of feeding experiments, involving four species of fish; namely, *Ophicephalus striatus* Bloch, *Glossogobius giurus* Buchanan-Hamilton, *Therapon plumbeus* (Kner), and *Anabas testudineus* (Bloch), which we demonstrated to be intermediate hosts of the parasite. And we remarked that this species of *Stamnosoma* was not identical with either of the two species the metacercariæ of which we had found in dissections of *Ambassis buruensis*. By actual dissections we have verified the presence of the metacercaria of *Stamnosoma formosanum* in the gills of *Therapon plumbeus* (Kner), mentioned above, as well as in those of another species of fish, namely, *Hemiramphus dussumieri* Cuvier and Valenciennes.

The metacercariæ are found in the fibrils of the gills and also in the soft tissues between the gill arches as tiny, ellipsoidal cysts which, under low power, show a grotesque-looking, actively turning larva. The cyst wall is thin, a fraction or more of a micron in thickness, but the tissue immediately surrounding the cyst (in the gill fibrils) is apparently compressed from pressure exerted by the developing larva, and forms a sort of a fibrous capsule around it which varies from 0.0025 to 0.005 mm in thickness. The actively moving worm shows a conspicuous, blackish, excretory tube which assumes bizarre shapes—from that of a Y resting on a base line, to N, Z, and other odd and capricious patterns—a feature which, as well as the more or less circular ventral sucker and the double row of 34 alternating, circumoral spines, at once engages the attention of the examiner. Gentle tapping of the cover glass overlying the cysts under examination suffices to cause the larva to excyst. In the extended, bottle-shaped, excysted trematode the anlage of the various organs integrating the adult can be distinctly made out. Anteriorly the oral sucker is prominent, with its double row of spines reminiscent of phonograph needles. It is subterminally placed, and from it arises a long prepharynx which is about three times as long as the œsophagus. The pharynx is squarish in outline, and the short œsophagus bifurcates at the junction of the anterior and middle thirds of the body into two rami, each of which courses laterally, following the curve of the body sides and gradually widening as it proceeds to end in a cul-de-sac a little beyond the level of the anterior border of the ovary, the two rami enclosing the circular ventral sucker situated at the junction of the middle and posterior thirds of the body, while their rounded-off,

blind ends partly enclose also the anlage of the ovary and receptaculum seminis, the latter being somewhat overlapped by the former. Side by side, on the same level, in the extreme posterior portion of the body, and separated from each other only by the Y-shaped excretory tube, are the two transversely ovoid, smooth testes. Within the intestine bright, transparent discs move up and down rhythmically.

In size the cysts range from 0.149 to 0.228 mm longitudinally, and from 0.1 to 0.142 mm transversely, while the excysted larvæ vary in length from 0.455 to 0.47 mm, and in width average 0.114 to 0.135 mm.

INCIDENCE, SITE, AND DEGREE OF METACERCARIAL INFECTION IN THREE SPECIES OF MARINE FISH

As stated in the introductory remarks, the three marine species of fish selected for this study were the following: *Hepsetia balabacensis* Jordan and Hubbs, *Hemiramphus georgi* Cuvier and Valenciennes, and *Ambassis buruensis* Bleeker. They were all small fish, the *Hepsetia* and the *Ambassis* ranging around 7 cm in length, and *Hemiramphus georgi* from 10 to 12 cm.

TABLE 1.—*Incidence of metacercarial infection in Hepsetia balabacensis, Ambassis buruensis, and Hemiramphus georgi.*

Name of fish dissected.	Number of fish dissected.	Number of fish positive for metacercariæ.	Incidence of infection.	Period of dissection.
			Per cent.	1937
Hepsetia balabacensis	416	169	40.625	April 3 to June 5.
Ambassis buruensis	414	228	55.073	March 30 to May 27.
Hemiramphus georgi	91	65	71.429	Do.

TABLE 2.—*Degree of metacercarial infection in Hepsetia balabacensis. Ambassis buruensis, and Hemiramphus georgi.*

Name of fish dissected.	Number of fish positive for metacercariæ dissected.	Minimum number of metacercariæ per fish.	Maximum number of metacercariæ per fish.	Average number of metacercariæ per fish.	Period of dissection.
					1937
Hepsetia balabacensis	76	1	302	22.94	May 7 to 27.
Ambassis buruensis	138	1	141	23.347	March 1 to May 27.
Hemiramphus georgi	27	1	2,008	226.4	March 4 to May 24.

TABLE 3.—*Order of frequency of metacercarial infection in various sites of body of Hepsetia balabacensis, Ambassis buruensis, and Hemiramphus georgi.*

Name of fish dissected.	Number of positive fish dissected.	Number and percentage of fish showing metacercariæ in various sites singly or simultaneously infected as grouped below:											
		Caudal fin only.		Flesh only.		Abdominal cavity only.		All fins simultaneously.		Caudal fin and flesh simultaneously.		Caudal fin, flesh, and abdominal cavity simultaneously.	
		No.	*Per cent.*	*No.*	*Per cent.*	*No.*	*Per cent.*	*No.*	*Per cent.*	*No.*	*Per cent.*	*No.*	*Per cent.*
Hepsetia balabacensis	49	1	2.04	8	16.33	13	26.53	0	0	1	2.04	4	8.16
Ambassis buruensis	59	0	0	2	3.39	48	81.36	1	1.69	0	0	0	0
Hemiramphus georgi	43	0	0	2	4.65	31	72.09	0	0	1	2.33	0	0

Name of fish dissected.	Number and percentage of fish showing metacercariæ in various sites singly or simultaneously infected as grouped below:										Period of dissection.
	Caudal fin and abdominal cavity simultaneously.		Flesh and abdominal cavity simultaneously.		Caudal fin (total).		All fins (total).		Flesh (total).		Abdominal cavity (total).		
	No.	*Per cent.*	*No.*	*Per cent.*	*No.*	*Per cent.*	*No.*	*Per cent.*	*No.*	*Per cent.*	*No.*	*Per cent.*	
Hepsetia balabacensis	0	0	22	44.89	6	12.24	0	0	35	71.43	39	79.59	1937 January 22 to April 8 (20 days).
Ambassis buruensis	0	0	8	13.56	1	1.69	1	1.69	10	16.95	57	96.61	January 25 to April 8 (24 days.)
Hemiramphus georgi	2	4.65	7	16.28	3	6.98	0	0	10	23.26	40	93.02	January 26 to May 2 (19 days).

NOTE.—In this tabulation the gills have been included under the designation "Abdominal cavity." Only *Ambassis buruensis* in this series of dissections showed metacercariae in the gills.

Under a dissecting microscope they were teased out to the finest particle, no nook, no corner, no bit, escaping the teasing needle and the scrutinizing eye, so that at the end of the dissection the fish had been reduced to powder, practically speaking, so thorough had been the carding to which it had been subjected. In the flesh the metarcercariæ are found in greatest number in the posterior portion of the body. In the abdominal cavity they are free, or more or less loosely attached to the viscera. In the gills they lodge in the fibrils. In the fins they attack the interradial web. The various sites occupied by the metacercariæ of *Stictodora guerreroi, Stictodora manilensis,* and *Haplorchis calderoni,* in so far as they concern these three fish, have been mentioned elsewhere in this paper, in the corresponding descriptions of these larval trematodes. Our dissections in pursuance of this survey extended over a period of six months, from January to June, 1937. For convenience, we give our findings in tabulated form. Table 1 shows the incidence of metacercarial infection in the three species studied; Table 2, the degree of this infection; and Table 3 indicates the sites of the fish's body infected by the metacercariæ, as well as the order of frequency of metacercarial infection in these sites. Table 4 gives the measurements of the various metacercariæ studied. The tables are self-explanatory.

REMARKS

The studies embodied in this report are complementary to the results of our feeding experiments(9, 10) for the determination of the piscine intermediate hosts of Philippine heterophyids, verifying, on the one hand, the identity of various species experimentally recovered, and furnishing, on the other, statistical data on the incidence, site, and degree of metacercarial infection in three species of marine fish, data which they supplement with information regarding the precise localization of the various heterophyid metacercariæ described.

Although, as stated by us in the introductory remarks, it is possible, by identifying the metacercariæ alone in a given fish, to determine the species of trematodes of which it is the second intermediate host, the amount of material, work, and time which this method entails in species which are found only occasionally, and in scanty numbers at that, is obvious, and, as far as we are concerned, actually familiar to us.

TABLE 4.—*Measurements of the various metacercariæ studied in this report.*

Name of metacercaria.	Name of fish.	Average size of encysted metacercaria from:—			
		Gills.	Caudal fin.	Flesh.	Abdominal cavity.
		mm.	*mm.*	*mm.*	*mm.*
Stictodora guerreroi	*Hepsetia balabacensis*		0.27 ×0.192	0.277 ×0.171	0.417×0.329
Do	*Ambassis buruensis*				0.530×0.4669
Do	*Hemiramphus georgi*		0.213 ×0.147		0.435×0.364
Stictodora manilensis	*Ambassis buruensis*			0.2869×0.230	0.379×0.331
Do	*Mugil dussumieri*				0.371×0.327
Do	*Gerris filamentosus*				0.306×0.270
Do	*Hepsetia balabacensis*		0.227 ×0.199	0.265 ×0.1689	
Haplorchis calderoni	*Hepsetia balabacensis*			0.1885×0.1423	
Do	*Anabas testudineus*			0.2276×0.1707	
Do	*Creisson validus*	0.224 ×0.171		0.2276×0.1802	
Haplorchis sisoni	*Therapon plumbeus*		0.2419×0.1636	0.2274×0.1496	
Haplorchis yokogawai	*Arius manillensis*			0.1806×0.1465	
Stellantchasmus falcatus	*Mugil dussumieri*			0.2242×0.1874	
Stamnoscma formosanum	*Therapon plumbeus*	0.1849×0.117			
Do	*Hemiramphus dussumieri*	0.1707×0.1138			

Name of metacercaria.	Name of fish.	Average size of excysted metacercariæ.	Thickness of cyst wall.	General average size of the encysted metacercariæ, hosts and sites combined.	General average size of the excysted metacercariæ, hosts and sites combined.
		mm.	*mm.*	*mm.*	*mm.*
Stictodora guerreroi	*Hepsetia balabacensis*	1.1739×0.249			
Do	*Ambassis buruensis*	0.7257×0.213			
Do	*Hemiramphus georgi*		0.0027	0.4144×0.3416	0.9498×0.2312
Stictodora manilensis	*Ambassis buruensis*				
Do	*Mugil dussumieri*	0.7968×0.3415			
Do	*Gerris filamentosus*				
Do	*Hepsetia balabacensis*		0.00257	0.3435×0.2894	0.797 ×0.342
Haplorchis calderoni	*Hepsetia balabacensis*	0.3666×0.1814			
Do	*Anabas testudineus*	0.5692×0.2703			
Do	*Creisson validus*	0.313 ×0.166	0.001665	0.224 ×0.175	0.3736×0.1885
Haplorchis sisoni	*Therapon plumbeus*	0.4109×0.1878	0.001744	0.228 ×0.151	0.4109×0.1878
Haplorchis yokogawai	*Arius manillensis*	0.4269×0.1849	0.001178		
Stellantchasmus falcatus	*Mugil dussumieri*	0.5905×0.2347	0.001932		
Stamnosoma formosanum	*Therapon plumbeus*	0.4648×0.128			
Do	*Hemiramphus dussumieri*	0.4624×0.128		0.1835×0.1166	0.4642×0.128

NOTE.—All measurements in this table are based on the study of fresh material.

Finally, we wish to state that we made no serious effort to trace out the excretory system of these heterophyids, beyond noting the presence of the excretory canals and flame cells, and their general arrangement in some of the metacercariæ here studied, because our main object in view was simply the identification of the metacercariæ.

SUMMARY AND CONCLUSIONS

1. Descriptions based on original morphological studies of Philippine material are herein given of the metacercariæ of *Stictodora guerreroi, Stictodora manilensis, Haplorchis calderoni, Haplorchis sisoni, Haplorchis yokogawai, Stellantchasmus falcatus* Onji and Nishio (=*Diorchitrema pseudocirrata*) and *Stamnosoma formosanum.*

2. Statistical data, based on actual dissection of hundreds of fish bought at random from the various markets of Manila, are herein presented on the incidence, site, and degree of metacercarial infection in three species of marine fish; namely, *Hepsetia balabacensis* Jordan and Hubbs, *Ambassis buruensis* Bleeker, and *Hemiramphus georgi* Cuvier and Valenciennes.

3. Direct evidence is furnished of the richness of Philippine fishes, marine and fresh-water, in heterophyid metacercariæ.

4. These morphological studies show that, at least in the case of the majority of heterophyids studied, identification of the metacercariæ in the fish host suffices to determine the species of heterophyids of which it is the second intermediate host. In the course of our dissections we have observed this to be true also of some nonheterophyids.

5. These studies are complementary to the results of our feeding experiments for the determination of the piscine intermediate hosts of Philippine heterophyid trematodes.(9, 10)

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ILLUSTRATIONS

[Microdrawings of metacercariæ before and after liberation from their cysts.]

PLATE 1

FIG. 1. Metacercaria of *Stictodora guerreroi* (encysted).
2. Metacercaria of *Stictodora guerreroi* (liberated).
3. Metacercaria of *Stictodora manilensis* (encysted).
4. Metacercaria of *Stictodora manilensis* (liberated).
5. Metacercaria of *Haplorchis calderoni* (encysted).
6. Metacercaria of *Haplorchis calderoni* (liberated).

PLATE 2

FIG. 1. Metacercaria of *Haplorchis sisoni* (encysted).
2. Metacercaria of *Haplorchis sisoni* (liberated).
3. Metacercaria of *Haplorchis yokogawai* (encysted).
4. Metacercaria of *Haplorchis yokogawai* (liberated).
5. Metacercaria of *Stellantchasmus falcatus* (encysted).
6. Metacercaria of *Stellantchasmus falcatus* (liberated).
7. Metacercaria of *Stamnosoma formosanum* (encysted).
8. Metacercaria of *Stamnosoma formosanum* (liberated).

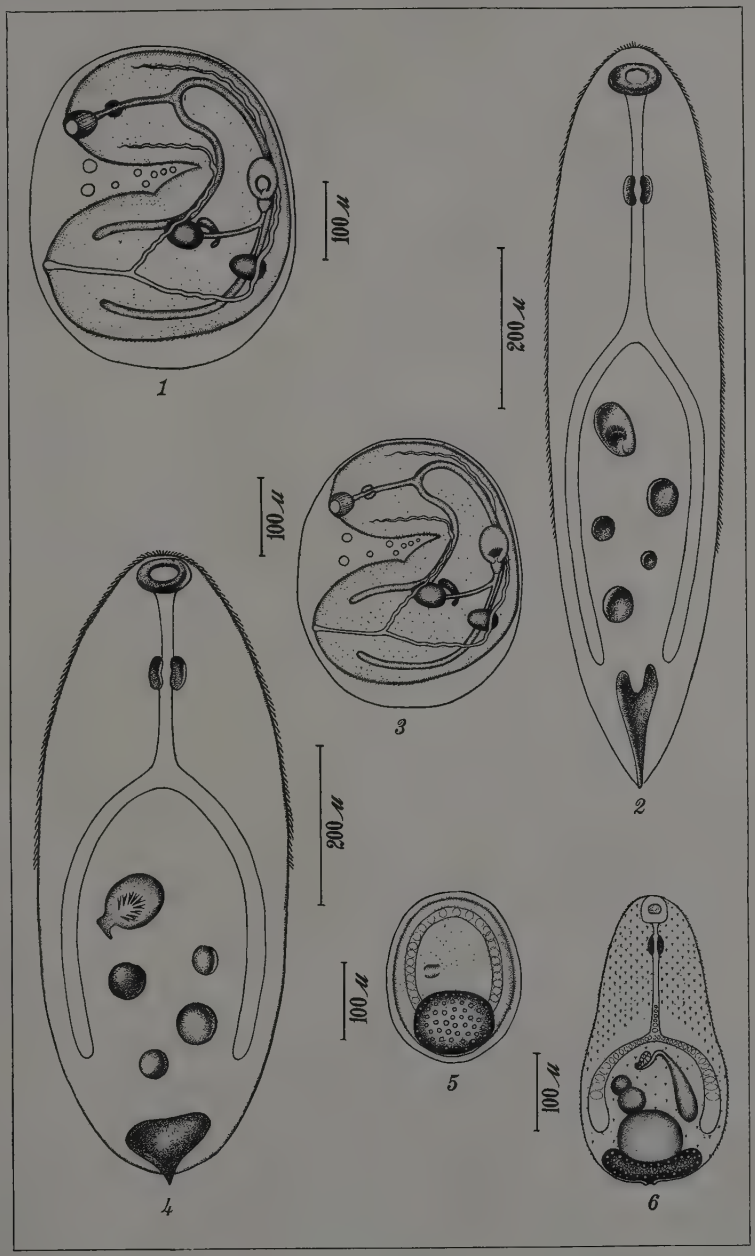

PLATE 1.

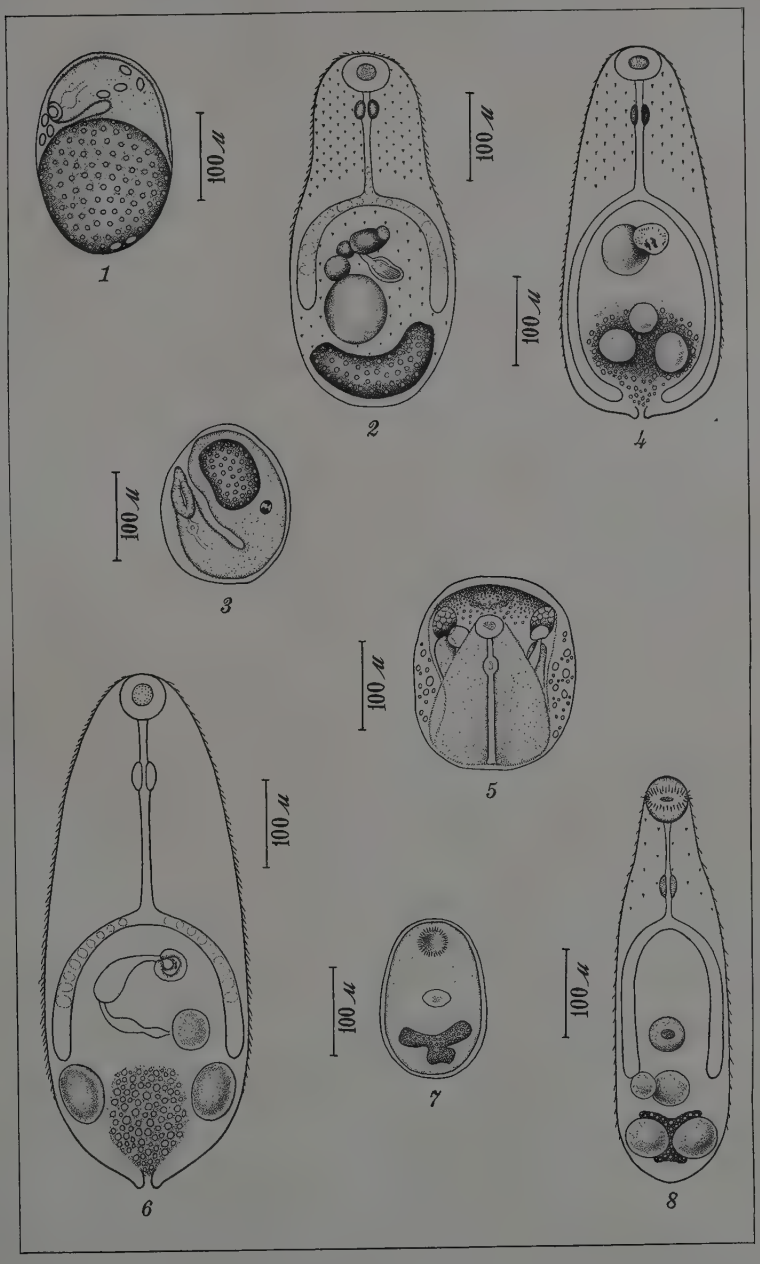

PLATE 2.

THE VERBAL PREFIXES *MAÑG* AND *MA* AND DEFECTIVE VERBS IN ILOKO

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I. THE TRANSITIVE PREFIX *MAÑG*

When a verb usually substantival has to be used in the adjectival construction for some reason or other, and has to remain transitive at the same time, the adjectival prefix *mañg* (past: *nañg*) is joined to the verb as it is, its prefixes remaining; its suffixes, however, are dropped.

All the forms of the prefix *mañg* which have been studied in preceding papers are of use here.[1]

Here follow the most important forms:

1. The suffixes *en* and *an* are changed into the prefix *mañg*. Examples:

asín ti mañgála iti asín?	who takes the salt?
siák ti nañgáwis iti ubíñg.	I coaxed the child.
dakamí ti nañgarámid.	we made it.
datayó ti mañgúray kenkuána.	we should wait for him.
dakamí ti nanáit iti bádona.	we sewed his coat.
asín ti mañgdúsa iti anákko.	who punishes my child?
dagití gayyémmi ti mañgdáwat.	our friends ask it.
siák ti mañgsaplít.	I shall whip him.
dagitóy ti nañgtúlad.	these imitated it.
isúda ti maniñgír.	they ask for the payment.
dagití kaaróbami ti nanúluy.	our neighbors continued it.
awán ti nanuñgpál.	nobody complied with it.
awán ti mamáti.	nobody believes it.
dakamí ti nañgpátit.	we rang the bells.
asín ti namarsuá iti lúboñg?	who created the world?
siák ti mañgpílit kenká.	I force you.
datayó ti mamonpón.	we should bury him.
siák ti mañguddót.	I shall nip him.
asín ti mañgbáut?	who whips him?
mamisíbiskayo kadagití múla.	water the plants.

[1] Notes on Iloko. Anthropos 33 (1928) 1037, 1038.

siká ti mamágay ití tálonko.	you should plant rice in my rice field.
siák ti maŋgágas kenká.	I shall give you medicine.
asín ti naŋgálad ití paraáŋgan?	who fenced the yard?
dakamí ti naŋgatép ití simbáan.	we roofed the church.
siká ti maŋgdalús kadagití ladáwan.	you should clean the pictures.
asin ti nanubálit ití súratna?	who answered his letter?
awán ti naŋgtúloŋg kenkuána.	nobody helped him.
isú ti namalúbos kenká.	he let you go.
awán ti maŋgaási kaniák.	nobody has mercy on me.
isúda ti naŋgimbág ití dákes.	they considered the bad as good.
awán ti maŋgapó kaniák.	nobody considers me as his master.
awán ti maŋgsapín itá lúpot.	nobody makes that cloth into trousers.
maŋginanámakami kenkuána.	we hope in him.
mamúnagkayo ití bató.	carry stones.
asín ti mamísos itóy pirákko?	who will make this money of mine a peso?
siák ti maŋgasín ití kárne.	I shall salt the meat.
awán ti naŋgraép.	nobody transplanted the rice.
dakayó ti naŋglukát kenkuána.	you opened the door for him.
isúda ti naŋgtúloŋg.	they helped him.
addá naŋgayáb.	somebody called you.
dakamí ti naŋgnáyon.	we augmented it.
siák ti maŋgkartíb.	I shall cut off a part.
addá paŋgúgasmo?	have you something with which to wash them?
paŋgaásim.	please.
kitáem ti pinanutúokda kenkuána.	look with what they tortured him.
aniá ti pinaŋgságadda ití agdán?	with what did they sweep the stairs?
aniá ti paŋgsatsátko itóy bádo?	with what shall I rip this coat?
isú ti pinaŋgtipédda ití yaáyna.	that is with which they impeded his coming.
awán ti panáit.	there is no thread.
aniá ti paŋgpísik?	with what shall I split it?
saludsúdenda kenkuána a paŋgsusúot.	they question him to try him.
aniá ti paŋgbáutko ití ubíŋg?	with what shall I whip the child?
awán ti paməáyadmi ití útaŋgmi.	we have nothing with which to pay our debts.
daytóy ti pinamárutko.	I pulled it with this.
aláem ti paŋgdúsam kenkuána.	take something with which to punish him.
isúda ti manaŋginúm ití árak.	they always drink wine.
isúda ti mananákaw.	they are the thieves.
mammartékda.	they are drunkards.
dagití mannálon.	the peasants.
awán ti paŋggatáŋganmi.	we have no place to buy it.
ni daytóy ti naŋgsurátanda.	they wrote to this one.
sadín ti panutuókanda kenkuána?	where do they torture him?
aniá ti pamusipúsanna?	why does he turn it?

sadín ti namilítanda kenkuána?	where did they force him?
pamiláwan.	blemish.
panusuótanna kenkuána.	how he tries him.
pamalpaliíwan.	a place for observation.
sadín ti naŋ̃ugásanda kadagití piŋ̃gán?	where did they wash the dishes?
asín ti pamatítanda?	for whom do they ring the bells?
sadín ti naŋ̃daítanna ití bádok?	where did she saw my coat?
mabayág ti panaŋ̃pátitda.	they ring the bells a long time.
nalagdá ti pammátida.	their faith is strong.
kasanó ti panaŋ̃gálatayo ití danúm?	how shall we draw water?
intonanó ti panaŋ̃gáwistayo kenkuána?	when shall we coax him?
kasanó ti panamakawánko?	how can I forgive him?
kaanó ti pannúladna?	when did he imitate them?
kasanó ti pananáitko itóy pandilíng?	how shall I sew this *saya?*
napigsá ti panaŋ̃báutna kaniák.	he whipped me with force.
ti pannutúokna.	his torturing.
ti pannaliáwmo.	your looking back.
ti pammílinko.	my order.
panaŋ̃baybay-á.	carelessness.
ti saánda a panamáti.	their unbelief.
kasanó ti pannúloŋ̃tayo kenkuána?	how shall we help him?
nalabés ti panaŋ̃tutúokda kadakamí.	they tortured us exceedingly.
deŋ̃ggém ti pananarítana ití napasámakna.	hear how he relates what happened to him.
kasanó ti pannaóna ití palímed?	how does he tell the secret?
napalálo ti panaŋ̃saplítna kadagití ubbíŋ̃.	he whipped the children too much.
kasanó ti panamagbagák itóy nasúbeg ŋ̃ga anákko?	how shall I advise this unruly child of mine?

NOTE 1. Complex prefixes derived from the above are: *maŋ̃tagi* or *managi, maŋ̃kara* or *maŋ̃gara, maŋ̃sag* or *manag,* and others. Examples:

dakamí ti maŋ̃tagikuá.	we are the owners.
siká ti managidákes kadagitá.	you consider those as bad.
aniá ti paŋ̃tagisayaátanda itá?	why do they consider that as beautiful?
idí kalmán ti panaŋ̃tagipatégmi kadakuáda.	yesterday we considered them as precious.
asín ti maŋ̃garasúrat?	who writes all the time?
siká ti naŋ̃karapugsát.	you broke it continually.
awán ti paŋ̃karakugtáranyo kadakuáda.	you have no reason to kick them continually.
kasanó ti panaŋ̃karabóoŋ̃mi?	how shall we break it continually?
isúda ti naŋ̃saggabassít.	they did it little by little.
isúda ti managgatló kadagití itédko.	they take each three of what I give.
awán ti paŋ̃sagduduáanmi ta awán ti nagyán.	we cannot take two each as it contains nothing.
kasanó ti panaŋ̃sagpipitómi?	how shall we take seven each?
dakamí ti maŋ̃sañgaíli.	we shall be their hosts.

kasanó ti panañgpakinákemko kadagitá?	how shall I think about those things?
isúda ti nañgkaiddá kaniák.	they lay down with me.

2. The prefix *i* and the combination *i . . . an* are changed into the complex prefix *mañgi*. Examples:

siák ti nañgyúlog.	I translated it.
dakamí ti mañgiláko.	we sell it.
isúda ti mañgitugkél.	they stick it in.
asín ti nañgibítin?	who suspended it?
awán ti mañgipákat.	nobody harnesses them.
mañgikúyogka ití ubíng.	take a child with you.
dakayó ti nañgiditóy.	you put it here.
mañgiruárka ití pirák.	bring forth money.
asín ti nañgitaráy?	who ran away with it?
mañgikábilda ití báñga.	they place a pot.
dakamí ti nañgidáit ití bádona.	we made a coat for him.
isú ti mañgisakdó kadagitá.	she draws water for those.
awán ti mañgigátañg kaniák ití bádok.	nobody buys a coat for me.
aláem ti dutdút a pañgyágasko.	take a feather for me to apply the medicine.
addá pinañgigálutko.	I had something to tie it with.
ti dágum ti pañgidáitmo.	use a needle to sew for her.
daytóy ti pinañgimúlak kenká ití sabá.	this is what I used to plant bananas for you.
manañgibálesda.	they always take revenge.
manó ti pañgilakoánna?	what is its price?
sadín ti pañgimuláantayo?	where shall we plant them?
ti baláymo ti nañgidulínanna.	he put it in your house.
awán ti pañgibilínanna.	he has nobody from whom to order it.
siká ti pañgibatiák.	I leave it with you.
isúda ti pañgyawátam.	give it to them.
aniá ti nañgisalakánanna kadatayó?	why did he save us?
siká ti nañgikariák itá baláy.	I promised that house to you.
ditóy ti pañgibabaák ití landók.	I shall lower the iron here.
aniá ti pañgibayoák kenká?	why should I pound rice for you?
idiáy ti nañgyaramídak ití agámañgna.	there I made a granary for him.
kasanó ti panañgiserrékko?	how can I put it inside?
idí kalmán ti panañgisublína.	he brought it back yesterday.
kasanó ti panañgyábutko kenká?	how can I hand it to you?
kaanó ti panañgitúgotna?	when did he take it with him?
kasanó ti panañgilútok kenká ití inapúy?	how shall I cook rice for you?
idí rabíi ti panañgigátañgko kenkuána ití púsa.	last night I bought a cat for him.

NOTE 2. Another complex prefix derived from the above is *mañgika*. Examples:

awán ti mañgikarígat ití bagína.	nobody chastises his body.
kasanó ti panañgikasígudna ití kinabaknáñgna?	how was he rich from the beginning?

3. The prefix *ipa* is changed into the complex prefix *mañgipa*. Examples:

isú ti nañgipapílit.	he insisted.
dagití mañgipapaárab.	the herdsmen.
mañgipabontókka kadagití manók.	go with the chickens toward Bontok.
isú ti nañgipasúroñg.	he went up the river with them.
awán ti mañgipapuñgán ití bató.	nobody uses a stone for a pillow.
pañgipakaonána.	his prophecy.
aniá ti nañgipaamianánanna?	why did he go northward?
asín ti pañgipaayám?	to whom do you apply it?
sadíno ti nañgipabaklayam?	where did you put it on his shoulders?
aniá ti pañgipañgronáam ití kastóy?	why do you prefer such a one?
kasanó ti panañgipabúlodko?	how shall I lend it?
idí malém ti panañgipaamítna kaniák ití bagás.	yesterday afternoon he gave me rice to carry.
itáy malém ti panañgipaláudna kadagití áso.	this afternoon he went westward with the dogs.
kaanó ti panañgipakaammóna kadakamí?	when did he let us know?
kastóy ti panañgipagtéñgna kadakamí ití kayátmi.	this way he gives us what we want.

NOTE 3. The combination *pakin . . . en* is changed into the complex prefix *mañgpakin* or *mamakin*. Examples:

siká ti namakinrabáw.	you put it uppermost.
awán ti mañgpakin-unég.	nobody puts it inside.
awán ti pamakindayáak kenkuána.	I have no place to put it east of (the others).
aniá ti pañgpakinlaúdanna kaniák?	why does he put me west of (the others)?
kasanó ti panañgpakin-amiánanko?	how shall I put it north of (the rest)?
idí bigát kalmán ti panamakinruárda.	yesterday morning they put it outside.
itáy ti pammakinbabámi.	we put it underneath just now.

4. The combinations *pi . . . en* and *pin . . . en*, and the complex prefixes *ipi* and *ipin*, *ikapi*, and *ikapin*, are changed into the complex prefixes *mañgpi* or *mami*, and *mañgpin* or *mamin*,

mañgipi and *mañgipin*, *mañgikapi* and *mañgikapin*, respectively. Examples:

siák ti mañgpinlimá.	I do it five times.
ti lakáy ti maminpát.	the old man does it four times.
addá mañgpitló.	somebody did it three times.
aniá ti pañgpitloám?	why do you do it three times?
sadíno ti naminpatánda?	where did they do it four times?
intóno bigát ti panañgpinwalómi.	to-morrow we shall do it eight times.
itá ti panaminlimámi.	now we do it five times.
itáy ti pamminpátda.	they did it four times just now.
ti ubíñg ti mañgipinsiám.	the child does it nine times.
datayó ti nañgipiduá.	we did it twice.
kasanó ti panañgipinpátna?	how shall he do it four times?
dakamí ti nañgikapinpitó.	we did it for the seventh time.
awán ti mañgikapitló.	nobody does it a third time.
ditóy ti nañgikapinwaloánda.	here they did it for the eighth time.
kaanó ti panañgikapin-innémna?	when did he do it for the sixth time?
idí kalmán ti panañgikapitlók.	yesterday I did it for the third time.

NOTE 4. This form clearly illustrates the composition of the multiplicative numbers. We refer the student to the section on the Number[2] where the multiplicatives were discussed in detail. It should be noted that the simple prefix *pi* becomes *pin* in this combination (*mamin*) when joined to the number two, *duá; piduáen* becomes *maminduá.*

5. The combinations *ka . . . en* and *ka . . . an* are changed into the complex prefix *mañgka* or *mañga*, which is rarely used. Examples:

dakamí ti nañgkaadú.	we augmented it.
siká ti mañgabayág.	you have it protracted.
awán ti mañgkapitó.	nobody makes it seven.

6. The combination *pag . . . en* is changed into the complex prefix *mañgpag* or *mamag*. Examples:

asín ti mamagtúbo kadagití múla?	who makes the plants grow?
asín ti namagtaráy ití kabáyo?	who made the horse run?
siák ti namagtálaw kenkuána.	I drove him out.
dakamí ti namagbáliw ití nákemna.	we made him change his mind.
mamaggaráwkami kadagití ubbíñg.	we make the children bustle.
isú ti namagári, kenkuána.	he made him king.
ti ímak ti pinamagpusípusko.	I turned it with my hand.
aniá ti pamagtaráymo kenkuána?	why do you make him run?
ti pamagulímek.	the signal for silence.
ti pinamagsiñggalút.	the tie.
ti pamagimbág kadagití tattáo.	the means to make men good.
isú ti namagsublasublátanna ití panagkarárag ken panagádalna.	that is why he prayed and studied in turn.

[2] Anthropos 28 (1933) 715, 716.

sadín ti namagtaláwanda kadakuáda?	where did they drive them out?
ditóy baláy ti pamagbaútanmi kadagití kakabsátmi.	we whip our brothers in this house.
kasanó ti panamagtálawda kenkuána?	how do they drive him out?
nasayáat ti panamagtúnosna kadakuáda.	he made them agree nicely.
ti panamagbalínna ñga árak ití danúm.	his changing water into wine.
kaanó ti panamagúñgarna kadagití natáy?	when did he raise the dead?
idí kalmán ti pammagúgasmi kadagití ubbíñg.	yesterday we made the children wash them.

NOTE 5. Other complex prefixes derived from the above are *mañgpagi* or *mamagi*, *mañgpag.inn* or *mamag.inn*, *mañgpagin* or *mamagin*, and others. Examples:

isú ti mamagisúrat.	he makes him write it.
kasanó ti panamagikárona?	how shall he expiate it?
dakamí ti namagtitinnúloñg kadakuáda.	we had them help one another.
ditóy ti pamaglinnaiñgánda kadagití agádal.	here they had the students vie in cleverness.
intonanó ti panamagbinnadañgbádañgtayo kadagití kaaróbatayo?	when will we have our neighbors help each other?
ti lakáy ti mamaginpipílay ití ubíñg.	the old man makes the child simulate lameness.
aniá ti pamaginkakatawáanyo kadakuáda?	why do you have them simulate laughter?
manmanó ti pammaginsasáñgitda kadakamí.	they do not often make us simulate weeping.

7. The combinations *pa . . . en* and *pa . . . an*, and the prefix *pa* are changed into the complex prefix *mañgpa* or *mama*. Examples:

aniá ti mamasayáat ití baláy?	what makes the house beautiful?
siák ti mañgpaságad ití silíd.	I have the room swept.
asín ti namaúli kadakuáda?	who brought them in?
siák ti mañgpaála.	I had them taken.
siká ti mamaúlog kadagitá.	you have those brought down.
ni Juán ti mañgpaarámid.	John has it made.
dakamí ti namainúm ití báka.	we watered the cow.
dagití babbái ti mañgpaabél.	the women had it woven.
isúda ti mamadígus ití nuáñg.	they bathe the carabaos.
awán ti mamaasín ití kárne.	nobody has the meat salted.
ti bakét ti mañgparikép.	the old woman has it closed.
ni Ana ti mañgpasóso ití ubíñg.	Ann gave the child the breast.
dakamí ti namalukát ití roáñgan.	we had the door opened.
dakayó ti mamasrék.	you have them come in.

ni Luís ti mamaraép ití tálon.	Lewis has the rice field planted.
ti lakáy ti mamaágas ití masakít.	the old man treats the sick.
ti ubíñg ti mamakáli.	the child has it dug.
isú ti mamagin-áwa kadatáo.	he tranquilizes one.
dagití mamasañgbáy.	the hosts.
mamatpatúladka ití dákes.	you give a bad example.
ti panagikkísko ti pamaúlogko kadagití áso.	my shouting puts the dogs out.
pamagásat daytá.	that is a charm.
aniánto ti pañgpanánam?	how shall we have them taste it?
daytóy maipapílit a pañgpawayváy.	we must use this to give them space.
pamadagsén ití biág ti kinapañgláw.	poverty makes life difficult.
pamalpaldáañg ti ipapatáy ti gayyém.	the death of a friend makes one sad.
pamainumán daydiáy.	that is a place to water (horses).
aniá ti pamaruáranda kadakamí?	why do they put us out?
adín ti namasosoám kenkuána?	where did you give it the breast?
ditóy ti pamakanák ití gayyémko.	I feed my friend here.
pamasrekán daytá.	that is a means of making money.
kasanó ti pammarígatda kadatáo.	how do they treat one hard?
ití kalpasán ti panañgpasúrotyo kenkuána.	after you have made him follow you.
kaanó ti panañgparígatna kenká?	when did he treat you hard?
ti panamaimbágna kadagití masakít.	his curing the sick.
ti pammaadúna kadagití parsuá.	his making the creatures multiply.
ti pammabainda kadakuáda.	their making them ashamed.
ti panamatalgédko.	my trust.
siák ti mamabírok ití ubíñg (from *pabiróken, bumírok*).	I tell the child to look for it.
siák ti mamabírok iti báñga (from *pabírok, biróken*).	I have the pot looked for.

8. The combination *pañg . . . en* is changed into the complex prefix *mañgpañg* or *mamañg*, which is rarely used. Examples:

siká ti mamañgrabii kadakamí.	you make us have supper.
sadíno ti pañgpañgaldáwam kadagití ubbíng?	where do you make the children have lunch?
intonanó ti panañgpamigátyo kadakamí?	when will you make us breakfast?

9. The complex prefixes *pai* and *paipa*, and the combination *pai . . . an* are changed into the complex prefixes *mañgpai* or *mamai* and *mañgpaipa* or *mamaipa*, respectively. Examples:

dakamí ti namayúlog.	we had it brought down.
ti kaaróbami ti mamaiserrék.	our neighbor has it brought in.
awán ti nañgpaipán.	nobody had it carried there.
siká ti mamaitúgot.	you tell (them) to take it with them.
isúda ti namaipaw-ít.	they had it sent.
awán ti namaidáit kenkuána ití bádo.	nobody had a coat made for him.

ditóy ti paŋ̃gpaikabílanna.	he has it put here.
idiáy ti pamaibitínanda.	they have it suspended there.
isú ti paŋ̃gpaibayoák ití bagás.	that is where I have rice pounded for her.
kaanó ti panaŋ̃gpaikúyogmo?	when did you make (him) take it with him?
ità ti panamaipúlaŋ̃da.	they have it returned now.
intóno bigát ti pammaikárona.	tomorrow he shall have them expiate it.
ti ubíŋ̃ ti namaipakán.	the boy had it given (to them) to eat.
dakayó ti mamaipainúm.	you have it given (to them) to drink.
isú ti mamaipabásol.	he has (them) accused of it.
awán ti paŋ̃gpaipainumánda.	they have no place to have it given (to them) to drink.
aniá ti pamaipabasólanyo?	why do you have (them) accused of it?
idí rabíi ti panaŋ̃gpaipaáyda.	last night they had it applied to him.
itáy malém ti panamaipalawágmi.	this afternoon we had it brought to Lawag.
kaanó ti pammaipapuŋ̃gánda ití bató?	when did they have a stone used as a pillow?

NOTE 6. The instrumental prefix *paŋ̃gpai* or *pamai* joined to names of towns, provinces, and so forth, means that something is usefully brought to the people of that town, province, and so on. Substantives Including Verbal Notions.[3] Examples:

pamaibaŋ̃gárko daytóy.	this is a good thing for me to carry to Bangar.
paŋ̃gpailawágmo daytá.	that is just the thing for you to carry to Lawag.

II. THE PREFIX *MA*

I. The passive is formed by joining the adjectival prefix *ma* (past: *na*) to the substantival verb as it is, its prefixes and suffixes remaining intact, except the suffix *en* which is dropped. The construction of this prefix and its combinations is adjectival, and most of the following forms may be used as simple attributes.

It will be seen readily that very often the prefix *ma* includes the notion of possibility, and the past form *na* that of completion of the action. We have alluded to these peculiarities when we explained the adjectival prefixes *maka* and *ma,* and the substantival prefix *ma.*

All the forms of the prefix *maka,* which have been studied in the preceding pages, are of use here; but the frequentative prefix *mannaka,* the instrumental form *paka,* and the prefix for

[3] The Iloko adjectival voice. Philip. Journ. Sci. 69 (1939) 249.

manner and time, *pannaka*, never allow any suffix, while the form for order or permission (*paka . . . en*) only allows the suffix *en* in the present, none in the past.

Here follow the most important forms:

1. The suffix *en* is changed into the prefix *ma*. Examples:

maála ti págay.	rice is taken.
nalúto ti inapúy.	the rice is cooked.
nabáutka?	were you whipped?
awán ti makíta.	there is nothing to be seen.
nasagána ti pagiddaán.	the bed is ready.
nasatsát ti bádok.	my coat is ripped.
siák ti madúsa.	I am punished.
mapígisto.	it will be torn.
napúkaw dagiti talík.	my ropes are lost.
idiáy ti nakagalípanna.	it was sliced there.
ditóy ti pakabiñgáyanna.	it is distributed here.
aniá ti nakaaramídanna?	why did it happen?
idiáy tálon ti pakaabúganda.	they are driven away from the rice field.
kaanó ti pannakabílañgna?	when was it counted?
itáy malém ti pannakadáitna.	it was sewn this afternoon.
kasanó ti pannakatarimáanna?	how is it arranged?
narígat ti pannakasimpána.	it is hard to level it.
kasanó ti pannakalútona?	how is it cooked?

NOTE. 7. *a*. Sometimes the initial consonant of the stem is changed into *m* or *n* after the prefix *ma*, giving the latter the form of the prefix *mañg*, although the meaning of the word remains essentially passive and does not at all become transitive; there is, however, a slight difference in the meaning of the ordinary form and that of the form in *m* or *n*, as the latter includes a certain shade of activeness. Perhaps the form alluded to in Notes on Iloko[4] may be placed in the same line, with this difference, however, that *mañgabaroánan* may never become *makabaroánan*. Examples:

manuñgpálakon.	I am done for.
matuñgpálto ti konám.	what you say will be done.
nanarimáan ti panagbáyo.	pounding rice was at its height.
natarimáan ti nabóoñg.	what was broken has been mended.

b. Complex prefixes derived from the above are: *matagi*, *makara*, *masag*, and so on. Examples:

mataginayon.	it keeps a long time.
matagitáo ti baláyna.	there are men in his house.
awán ti natagiláko.	nothing was sold.
makarapugsát.	it is always snapped.
masaggabassít.	it is done little by little.

[4] Chapter I, VI. Syncopations. Anthropos 23 (1928) 1039.

2. The suffix *an* is changed into the combination *ma . . . an*. Examples:

nasagádan ti silíd.	the room is swept.
naasinán ti inapúy.	the rice is salted.
maraepán komá ti tálon.	the rice field should be planted.
no maluktán ti roáñgan.	if the door is opened.
nasilián ti digó.	the broth is peppered.
makissayánto.	it will be diminished.
manayónan.	it must be augmented.
naayabán idí kalmán.	he was called yesterday.
natakáwan ti gayyémko.	my friend was robbed.
makapásan ti bañgkágmi.	our field will be planted with cotton.
nadanumán.	it has been watered.
aniá ti pakabantáyanna?	why is it watched?
awán ti pakarugitánna ditóy.	it shall not get dirty here.
sadíno ti nakabadáñganda?	where were they helped?
kaanó ti pannakatúloñgna?	when was he helped?
nadarás ti pannakasibúgda.	they are quickly watered.
kasanó ti pannakadalúsna?	how is it cleaned?

NOTE 8. The combination *maka . . . an* with numbers is rarely used.[5] Examples:

makaduáan.	it has a companion.
saán a makaduáan, maminpinsán láeñg.	it does not happen twice, only once.

3. The prefix *i* is changed into the complex prefix *mai*. Examples:

naisúrat.	it is written.
mayáyus ti róot.	the grass is carried away by the current.
dagití naisagána.	those that have been prepared.
maipánto idiáy.	it will be brought there.
naiserrék ti alikámen.	the furniture is in.
maipúlañg komá.	it should be returned.
naitaráy kanó.	they say that they ran away with it.
awán ti naisublí.	nothing was brought back.
isú ti naikúyog.	they took it with them.
daytóy ti maisañgpét.	this is what is brought home.
addá naipaw-ít.	some has been sent.
ti nakaipatoán.	the fate.
dagití pakaidindinnaánna.	those whom he frequents.
sadíno ti nakaikabílanna?	where was it placed?
ditóy ti pakaidissoánna.	it should be put down here.
idiáy ti nakaidulínanna.	it was put aside there.
kasanó ti pannakaibílañgna?	how is it considered?
kasanó ti pannakaigálutna?	how is it tied?

[5] The Adjectival Prefix *Maka*. II. 4. Philip. Journ. Sci. 69 (1939) 234.

napintás ti pannakaimúlada.	they are nicely planted.
itáy ti pannakaibátina.	he was left just now.
intonanó ti pannakailíbutna?	when will it be taken in procession?

NOTE 9. *a.* Other combinations derived from the above are: *mai...an, maika, maika...an* and others. Examples:

maidaítan ití bádo.	he has a coat made for him.
mainagánantayo.	we are named.
ti naikasígud a kababalínna.	his natural habit.
isú ti nakaikasigúdanda.	it is their nature.
padapádada a nakaikapatáyan tí lintég.	they fall under the same law.
maipakaoná.	it is foretold.
ti pannakaipakaammóna.	its announcement.
maisañgaáwisak.	I am also invited.
maisañgabáñgon.	it is raised also.

b. The form *maika* clearly illustrates the composition of the ordinal numbers. We refer the student to the section on the Number, where the ordinal numbers were discussed in detail.[6]

4. The prefix *ipa* is changed into the complex prefix *maipa*. Examples:

maipastrékda.	They are put inside.
naipadpadúma.	it is different.
maipalnédkanto.	you will disappear.
maipabigát daytá.	that will be left for tomorrow.
naipabúlod kaniák.	it was lent me.
maipakán ti págay.	he is fed with rice.
maipaáy.	it is convenient.
naipasúroñg ti bábuy.	the hog was brought up the river.
isú ti nakaipapilítak ñga immyánen.	that is why I was obliged to stay overnight.
aniá ti nakaipababaánna?	why was it brought downward?
kasanó ti pannakaipañgátona?	how was it raised?
idí kalmán ti pannakaipaárabda.	they were taken to the pasture yesterday.

NOTE 10. *a.* The combination *pakin...en* is changed into the complex prefix *mapakin*. Examples:

mapakindáya daytóy.	this must be put on the east side.
aniá ti nakapakinrabawánna?	why was it placed uppermost?
kasanó ti pannakapakinruárna?	how was it put outside?

b. The prefix *maipañg* differs from the prefix *maipa* in the same way as the transitive prefix *mañg* from the intransitive prefix *ag*. It is rarely used. Example:

naipannurók.	superabundant, more than (the others).

[6] Anthropos 28 (1933) 714, 715.

5. The combinations *pi . . . en* and *pin . . . en*, and the complex prefixes *ipi* and *ipin* and *ikapi* and *ikapin* are changed into the complex prefixes *mapi* and *mapin*, *maipi* and *maipin*, and *maikapi* and *maikapin*, respectively. Examples:

maipitló.	it is done three times.
napinlimá.	it was done five times.
naipinpitó.	it was done seven times.
maipin-inném.	it is done six times.
napiduá.	it was done twice.
maikapinpát.	it is done a fourth time.
aniá ti pakapinsiámanna?	why is it done nine times?
pannakaipiduána a maimaldít.	second edition.
kasanó ti pannakaikapinwalóna?	how was it done an eighth time?

NOTE 11. As the prefix *ma* has sometimes a tendency to become *ka*, especially in the formation of substantives, the preceding form abundantly illustrates what we have stated before about the composition of substantives which serve to indicate the degrees of kindred.[7]

6. The combination *pag . . . en* is changed into the complex prefix *mapag*. Examples:

mapagúñgar.	it is raised to life.
napagsaóak.	I am told to talk.
dagití napagbabáwi.	those who were brought to repentance.
tapnó mapagtitípun ñga agkaykaysá.	so that it be made into one with the rest.
ditóy ti nakapagsubliánna.	it was sent back here.
kasanó ti pannakapagtaráyna?	how did they make it run?

NOTE 12. Other complex prefixes derived from the above are: *mapagi*, *mapag.inn.*, *mapagin*, and others. Examples:

mapagikábil.	he is ordered to place it.
napagtitinnúloñgda.	they were forced to help one another.
mapaginsasáñgitkayo.	you are forced to simulate weeping.

7. The combination *pa . . . en* and the prefix *pa* are changed into the complex prefix *mapa*. Examples:

napapúdaw.	it was whitened.
ti mapasúñgad.	the future.
mapatúleñgda ámin.	they were all rendered deaf.
mapasadútak ñga aramíden.	I am made unwilling to do it.
napabílegak a napán.	I was strengthened to go.
napabpabásol ni gayyémko.	my friend was accused.
napaaddá ti bagás.	rice was caused to appear.
napatúluy ti sarítana.	his story was finished.
napakutí ti báñga.	the pot was made to move.
napabáutkami.	we were forced to whip.

[7] Formation of Substantives. III. 5. Anthropos 26 (1931) 473.

napasagána ti ulés.	a blanket was caused to be prepared.
napaarámid ti lamisáan.	a table was caused to be made.
ditóy ti nakapatarayánda.	they were driven here.
awán ti pakapaboóñgan.	there is no reason to have it broken.
ditóy ti nakapadakkelánna.	he was brought up here.
isú ti pakapadayáwak.	that is why I am honored.
kaanó ti pannakaparsuá ti lúboñg?	when was the world created?
intonanó ti pannakapainúm dagití nuáñg?	when will the carabaos be watered?
kasanó ti pannakapaarámidna?	how will it be caused to be done?
napabírok ti napúkawna (from *pabírok, biróken*).	what he lost was caused to be looked for.
napabírok ti ubíñg (from *pabiróken, bumírok*).	the child was caused to look for it.

8. The combination *pañg . . . en* is changed into the complex prefix *mapañg*. Examples:

mapañgála ti lakáy.	the old man is forced to take it.
napamírok dagití ubbíñg.	the children were forced to look for it.

9. The combinations *pa . . . an, pai . . . an,* and the like, are changed into the combinations *mapa . . . an, mapai . . . an,* and others. Examples:

maparañgkápan ti ubíñg.	the child is caused to be given a present.
napaldaáñgan dagití naganák kenkuána.	his parents were grieved.
napanagánan.	he was named.
mapasagádan ti silíd.	the room is caused to be swept.
maparikpán ti táwa.	the window is caused to be closed.
napatulóñgan ti anákko.	my son was caused to be helped.
mapalanáan ti lálat.	the leather is caused to be oiled.
ditóy ti pakapaluktán ti táwa.	the window is caused to be opened here.
kaanó ti pannakaparaép ti tálon?	when was the rice field caused to be planted?
mapaigatáñgan ni Juána ití bádo ti anákna.	Joan was caused to be given a coat for her child.

10. The complex prefixes *pai, paipa,* and the like are changed into the complex prefixes *mapai, mapaipa,* and so on. Examples:

mapairuár ti págay.	rice is caused to be taken out.
napaibabá ti atépna.	its roof was caused to be lowered.
mapaidúlin ti bagás.	the rice is caused to be put away.
napaigátañg ti salapí.	fifty centavos were given to buy it.
napaipúlañg.	it was caused to be returned.
ditóy ti pakapaisubliánna.	it is caused to be returned here.

kasanó ti pannakapayunégna?	how was it caused to be put inside?
napaipabúlod ti báñgami.	our pot was caused to be lent.
mapaipaútañg ti pirákda.	their money is caused to be lent.
napaipainúm daytá danúm.	that water is caused to be drunk.
idiáy ti nakapaipalaúdanna.	there it was caused to be brought westward.
kaanó ti pannakapaipasúroñgna?	when was it caused to be brought up the river?
kasanó ti pannakapaipadáyana?	how was it caused to be put eastward?

II. These forms may be used with the substantival construction as has been stated before under the Substantival Prefix *Ma*,[8] and whatever has been said about the adjectival prefix *ma* in section I may be repeated here for the substantival prefix *ma*, except: (*a*) that the latter is substantival in construction, while the former is adjectival; (*b*) that the latter indicates either active possibility or completion of the action, while the former represents the passive voice.

1. The prefix *ma*. Examples:

masápulko.	I need it.
nakítami ti púsayo.	we saw your cat.
naawánna ti riknána.	he lost his senses.
nakámatyo idá.	you caught them.
naáwismi dagití gayyémmi.	we convinced our friends.
makamákamminto idá.	we shall catch up with them.
maáwatko ti konám.	I understand what you say.
maláonna ti uppát.	it holds four.
nabátik idiáy.	I left it there.
nabáutko.	I whipped him.
adíno ti nakakabílam kenkuána.	where did you beat him?
aniá ti pakasapúlam itá?	what do you want there?
kasanó ti pannakakítamití baláyko?	how can you see my house?
kaanó ti pannakaarámidmo itá agámañg?	when did you make that granary?

Note 13. Complex prefixes derived from the above. Examples:

natagikuámi dagitóy ñga alikámen.	we owned this furniture.
nataginayonna ti siñgpétna.	he remained virtuous.
makarasúratko.	I can write it continually.
masaggabassítna ñga aramíden.	he makes it by little and little.

2. The combination *ma . . . an*. Examples:

dídanto maramanán ni patáy.	they will not taste death.
naasinánmi ámin.	we salted it all.
maraepánminto no bigát.	we shall plant it tomorrow.
nadalusák ti silíd.	I cleaned the room.

[8] The Iloko substantival voice. Philip. Journ. Sci. 71 (1940) 22.

naugásanyo dagití piñggán.	did you wash the dishes?
narikpántayo idá ámin.	we closed them all.
malukatánda.	can they open them?
nakartíbanda ti lúpot.	they cut off a part of the cloth.
sadín ti pakalanáanda kadagití sapátos?	where can they oil the shoes?
sadín ti nakatulóñganda kadagití gayyémmi?	where did they help our friends?
kaanó ti pannakalúkasda kadagitá?	when did they uncover those?
kasanó ti pannakabáliwmi itá?	how can we change that?

NOTE 14. The combination *maka . . . an.* Example:

nakawaloándakami.	they took eight of us.

3. The complex prefix *mai.*

naisimpána.	he leveled it.
maisabálik.	I talk about something else.
mayúlogna kanó.	they say that he can translate it.
nayúlina ámin.	he brought them all in.
naipákatna.	he harnessed it.
maipaw-ítna ti súrat.	he can send the letter.
naibabámi idá.	we lowered them.
naipúlañgmi ti binúlodmi.	we returned what we lent.
daytóy ti pakailasínanyo iñga inayák.	this is how you will know my coming.
sadín ti pakaikabílam kadagitá?	where can you put those?
kasanó ti pannakailísimi iti peggád?	how can we avoid danger?
kaanó ti pannakayálisyo kadagití kúkuayo?	when did you move your property?

NOTE 15. Other combinations derived from the above. Examples:

tapnó maidawátam idá.	so that you can ask things for them.
naigatáñganyo ti baláy.	did you buy a house for him?
maibirókanminto.	we shall find it for him.
naikasigudna.	he always was so.
ti kinabaknáñgko naikasigúdak únay.	I was rich from the very beginning.

4. The complex prefix *maipa.* Examples:

naipainúmko ámin.	I had it all drunk.
maipakánna ti págay.	he can have the rice fed.
naipabontókna.	he had it brought toward Bontok.
maipañgátomi.	we can raise it.
sadín ti nakaipababaánda kadagitá?	where did they bring those downward?
kaanó ti pannakaipasúroñgmi kadakuáda?	when did we bring them up the river?
kasanó ti pannakaipapuñgántayo itá?	how can we use that as a pillow?

NOTE 16. The complex prefix *mapakin.* Examples:

mapakindáyak.	I can put it on the east side.
napakin-amiánanna.	he put it on the north side.

5. The complex prefixes *mapi* and *mapin*, *maipi* and *maipin*, and *maikapi* and *maikapin*. Examples:

napitlók.	I did it three times.
mapinlimámi.	we can do it five times.
naipiduána.	he did it twice.
maipinsiámna.	he can do it nine times.
maikapinpátna a mapán.	he can go there a fourth time.
naikapinpitóyo ñga inarámid.	you did it a seventh time.

6. The complex prefix *mapag*. Examples:

saánda a mapaglásin dagitá.	they cannot see the difference between those.
napagbírokmi idá a duá.	we had them both look for it.
mapagtálawyo idá ití áso.	can you have them drive away the dog?
napagsarítada ni Juán.	they made Juan talk.
saánmi a napagságad ti ubíñg.	we could not make the boy sweep it.
mapagádalna ti anákna.	he can make his son study.
sadín ti pakapagaramídanda kadakuáda?	where can they have them make it?
kasanó ti pannakapagdáityo kadakuada?	how can you make them sew it?

NOTE 17. Other complex prefixes derived from the above. Examples:

mapagisañgpétmi.	we can make them bring it home.
napagsinnublátmo.	you made them take turns.
mapaginbubulsékko dagitá.	I can make those simulate blindness.

7. The complex prefix *mapa*.

mapabírokko ti ubíñg (from *pabiróken, bumírok*).	I can have the child look for it.
mapabírokko ti nuáñg (from *pabírok, biróken*).	I can have the carabao looked for.
mapaimbágmi dagitóy.	we can cure these.
napasápultayo dagití nuáñg.	we had the carabaos looked for.
mapatugáwyo idá.	you can have them sit down.
napatakdérda idá ámin.	they had them all stand up.
mapabáutmo ti anákmo?	can you have your child whipped?
napasaplítmi ti nagsúkir.	we had the disobedient one whipped.
napasublína a sikakaradkád.	he had him brought back in good health.
dagití mapasúrotda.	their followers.
idí napasañgpétna toy anákna.	when he had this son of his brought home.
sadín ti nakapainumánda kadakuáda?	where did they have them watered?
sadín ti pakapaaláantayo?	where can we have it taken from?
kaanó ti pannakapakánmi?	when did we feed him?
kasanó ti pannakapaarámidko?	how can I have it made?

8. The complex prefix *mapañg*. Examples:

mapañgaldáwmi idá.	we can make them take lunch.
napamigátko ti gayyémko.	I made my friend breakfast.
napanaplityo ti lakáy?	did you make the old man whip them?
napañgálam dagití bakét ití kayátmo?	did you make the old women take what you want?

9. The combinations *mapa . . . an, mapai . . . an,* and the like.

mapasagádam ti silíd.	can you have the room swept?
naparaepánmi ti tálon.	we had the rice field planted.
mapalukatántayo dagití táwa.	we can have the windows opened.
naparikpánda idá.	they had them closed.
napatapiányo ti bíto.	you had the pit covered with a stone.
napaayabánda ti gayyémda.	they had their friend called.
mapatulóñganmi ti nakákaasi.	we can have the miserable helped.
mapasukatánta dagidiáy?	can we have those changed?
sadíno ti pakapabayádam ití útañgmo?	where can you have your debt paid?
kasanó ti pannakapaasínmi kadagitá?	how can we have those salted?
kaanó ti pannakapapágayyo ití tálon?	when did you have rice planted in the rice field?
mapayaramídanmi ti baláy?	can we have a house made for him?
napaibayoánmi idá.	we had people pound rice for them.
mapaidawátanda idá ti kalikagúmanda.	they can have what they desire asked for them.
kasanó ti pannakapaigátañgda kadakuáda ití lúpot?	how can they have cloth bought for them?

10. The complex prefixes *mapai, mapaipa,* and the like. Examples:

mapaitúgotmi idá ámin.	we can have people take them all with them.
napairuártayo.	we had them taken out.
napaipúlañgko ti inpabúlodko.	what I lent I had brought back.
napaisañgpétda dagití tarikáyo.	they had the timber brought home.
mapayálisna ti balávna.	he can have his house moved.
napaidúlinmi ti pirák.	we had the money put away.
napaikastámi.	we had it done like that.
idiáy balávmi ti nakapaibatiánda ití ásoda.	they had their dog left in our house.
ditóy ti nakapaidissoám.	you had it put down here.
sadíno ti pakapaidissaáganmi kadakuáda?	where can we have them taken off?
itáy ti pannakapaikábilda kadakuáda.	they had them placed just now.
idí kalmán ti pannakapaisublímí kadagitóy.	yesterday we had these brought back.

kaanó ti pannakapaipaw-ítyo?	when did you have it sent?
kasanó ti pannakapayunégmi?	how can we have it put inside?
mapaipasúroñgmi ti manók.	we can have the chicken brought up the river.
napaipabásolda ití kaaróbada.	they had their neighbors accused of it.
idiáy ti pakapaipababaányo kadagití burnáy?	can you have the jars lowered there?
kasanó ti pannakapaipalawágda kadakuáda?	how can they have them brought to Lawag?
kaanó ti pannakapaipaditóyyo ití nuáñg?	when had you the carabao brought in this direction?

NOTE 18. *a.* We have seen under the adjectival prefix *ma*[9] how the suffix *an*, as a true locative, may modify the meaning of a verb in *ma*. It should be noted that there is a great difference of origin between these forms in *ma . . . an* and those explained under I, 2, and II, 2, above. In the latter forms the suffix *an* belongs to the original substantival verb, with which the prefix *ma* has been combined to form either an adjectival passive verb or a substantival verb meaning possibility or completion of the action, while in the former the suffix *an* does not belong to the original substantival verb, but is simply a modification of the verb in *ma*. Both forms however, are identical in construction and meaning.

Besides the examples given under the adjectival prefix *ma*, where the prefix was a simple one, we give here some other examples of forms in *ma . . . an*, where the prefix is either simple or complex. Examples.

Adjectival:

mapakuyógan ití dakkél a pannakabalín.	it is accompanied by great power.
mapaawitánda ití nadagsén.	they are loaded with heavy burdens.
nalaká a mapasagídan.	he is easily offended.
mapabpabutñgánda.	they are frightened.
madanáganak.	I am very much worried.
nabannogán dagití táo.	the men were tired out.
saán a maawátan.	it cannot be understood.
marigátan.	he is dangerously ill (or, he is in a difficult position).

Substantival:

maawátak ámin.	I understand everything.
masapúlakto.	I shall find it.
nabirókanmi daydí kallogóñg.	we found that hat.
napasagídak ni gayyémko.	I hit my friend (by some allusion).
napaawitánda idá ití nadagsén.	they gave them a heavy load.
mapakuyógantay idá.	we can have them accompanied.
napabutñgánna ti anákna.	he frightened his son.

[9] The Iloko Adjectival Voice. Philip. Journ. Sci. 69 (1939) 240.

b. The past form *nai . . . an* may sometimes become *nain . . . an.*[10]

Examples:

nainkalintegán.	having the right.
ti nainkasigúdanyo a pagimbagán.	your original welfare.

c. The prefix *ma* may sometimes be changed into *ka*, without changing the meaning of the word. Its past form remains *na*. Examples:

Adjectival:

dínto ñgatá kaibuksílan.	perhaps it will be impossible to explain it.
di kasupapákan.	it cannot be gainsaid.
di kaliklíkan.	it cannot be avoided.
ti di kalansádan a panañgñgaásina.	his immeasurable mercy.
a kas kaimatáñgan ití inarámidmo.	as may be seen by what you did.

Substantival:

kaikariánna ti taráonna.	he deserves his sustenance.
no kaay-áyonakto pay.	if you will still be able to coax me.
díkam komá kalipátan ti imbágna.	we should not forget his kindness.
kaimatáñgantayo ti balákadna.	let us heed his advice.
díak kasurótan.	I cannot follow it.
kagteñgánminto.	we shall be able to reach it.

III. IRREGULAR AND DEFECTIVE VERBS

Nearly all the verbs of the Iloko language are formed by joining prefixes, infixes, or suffixes to verbal stems, as has been explained above. However, there are a few defective verbs and a few others which have some distinctive peculiarities, and we shall say a word about them here.

1. *IN*

This verb, which means "to go", and is often used as an auxiliary, always remains invariable, and allows neither prefixes nor suffixes.

I. When used by itself *in* follows the rules of the adjectival voice, and consequently allows the personal pronouns of the second series. When the personal pronoun of the third person singular (second series) is understood, or when the subject of the verb is emphasized, the verb *mapán* takes the place of *in*, because the latter never stands by itself; the verb *napán* is generally preferred also for the past tense. Examples:

ínnak idiáy.	I go there.
ínka idiáy baláymo.	go to your house.
ínkami.	we go.

[10] Comparatives and Superlatives. III. 3. Anthropos 26 (1931) 479, note.

índa idiáy Baknótan.	they go to Baknotan.
mapán.	he goes.
isúda ti mapán.	it is they who go.
siák ti napán.	it was I who went.
napánkami.	we went.

II. When used as an auxiliary, it depends on the construction of the principal verb, and *mapán* (past: *napán*) often takes its place, if the personal pronoun of the 3d person singular is understood or if the principal verb is in the past. The peculiarities connected with the use of the possessives, when *in* serves as an auxiliary to substantival verbs, have been alluded to in another paper.[11] Examples:

ínnak uminúm.	I go to drink.
íntayo mañgán.	let us go to eat.
ínkay aláen.	go and take it.
ínna saganáen.	he goes to prepare it.
ti bakét ñga in sarongkáran ti lakáy.	the old woman whom the old man goes to visit.
ti úleg a mapán patayén ni Juán.	the snake that John goes to kill.
no in agsáad.	when he goes to get a position.
mapán matúrog.	he goes to sleep.
ti ubíñg ñga in nagdaydáyaw kenkuána.	the child who went to revere him.
ínkam inála or *napánmi inála.*	we went to take it.
napánkami mañgála.	we went to take some.

NOTE 19. This auxiliary is sometimes added to another word without changing the latter's meaning, especially in poetry and flowery speech. Examples:

ti ínna kasasáad.	his position.
idí ínna kasisígud.	at its beginning.
ti turáy ti ínna kadinnaég.	the authority is what he reveres.
in makláat.	it happens suddenly.
índakto patién?	will they believe me? are they going to believe me?

2. *PAN*

This stem allows several of the prefixes and suffixes of both the adjectival and the substantival voice, but the verbs it forms are irregular in many respects.

1. *Mapán* (past: *napán*): to go. When used by itself, this form follows the rules of the adjectival constructions; when used as an auxiliary, it depends on the construction of the principal

[11] Possessives. 2. Peculiarities. Anthropos 28 (1933) 691.

verb for its own adjectival or substantival construction. Examples:

mapánkami.	we go.
napánkayo idiáy.	you went there.
mapánkami mañgála.	we go to take some.
napán nagsúrat.	he went to write.
mapánmi aláen.	we go to take it.
napánna insúrat.	he went to write it down.

1. The form for the place where one goes is *papanán* (past: *napanán*), instead of *pakapanan.* Examples:

sadín ti papanám?	where do you go?
idiáy ti napanánna.	he went there.

2. The form for the manner how and the time when one goes is *ipapán,* instead of *pannakapan.* Examples:

intonanó ti ipapánna?	when does he go?
maipapán iti ipapánna.	concerning his going.

NOTE 20. The regular verb *agapán* and the auxiliary *apán* (past and present) occur sometimes. Examples:

managapán.	he often goes.
magun-ódnanto ti apánna gagaráen.	he will obtain what he intends going there.

II. *Ipán,* to carry, to bring, and *ipapán,* to deem, are regular substantival verbs in *i* and *ipa* respectively, which may be combined with other prefixes and suffixes. Examples:

ipánmo idiáy.	carry it there.
inpánko ken áma.	I carried it to my father.
siák ti nañgipán.	I carried it.
naipánen.	it was carried already.
sadín ti nañgipanányo?	where did you carry it?
isú komá ti agipán idiáy baláymi.	he should carry it to our house.
paipánmo.	have it carried.
ipapánko a dákes.	I suppose it to be bad.
managipapánkayo.	you are suspicious.

NOTE 21. *Agpapán* represents the preposition "till", and *maipapán,* the conjunction "concerning".[12]

3. *UMÁY*

The prefix *um* of the verb *umáy,* which means "to come", is sometimes considered as a part of the stem in combinations with other prefixes or suffixes. Examples:

paumayém ditóy.	have him come here.
agkaraumáy.	he comes all the time.

[12] The Preposition. III, 1. The Conjunction. IX. The Conjunction "Concerning". I. Unpublished.

4. *PAGNÁ*

I. The verbs formed with this stem are entirely regular in most of their forms. Examples:

nagpagpagná.	he was walking.
makapagná.	he can walk.
ipagnána ti bákes ditóy.	he comes along here with the monkey.
pagpagnáem idiáy.	make him walk there.
ti panamagpagnák kenkuána.	my ordering him to walk.
itáy ti panañgpagnána kaniák.	he ordered me to walk just now.

II. The following forms are irregular:

1. *Magná* (past: *nagná*), to walk, which is a contraction of the adjectival prefix *ma* and the stem *pagná*. Examples:

magnákami apó.	we come along, Sir.
nagnáda idiáy báñgir.	they walked at the other side.

2. The form for the place where one walks is *pagnáan* (past: *nagnáan*), instead of *pakapagnaan* or *pakagnaan*. Examples:

awán ti pagnáan ditóy.	this is no thoroughfare.
idiáy ti nagnáanna.	he passed there.

3. The form for the manner how and the time when one walks is *pannagná*, instead of *pannakapagna* or *pannakagna*. Examples:

kitáem ti pannagná ti lakáy.	look how the old man walks.
kaanó ti pannagná ti ubíñg.	when did the child walk?

5. *KAYÁT*

This verb, which means "to like, to be willing", follows the rules of the substantival construction. It is a contraction of the prefix *ka* and the stem *ayát*.

1. In the present it is used without any further prefix or suffix; its past form is *kinayát*. Examples:

kayátko daytá.	I like that.
kayátna ti uminúm.	he wants to drink.
kinayátda.	they liked it.
kinayátmi idí kalmán.	we liked it yesterday.
nalaús ti panañgkayátda itóy ásomi.	they like this dog of ours very much.

2. The substantival form *kayatén*, for the present, and the forms of the adjectival prefix *ag* (*agkayát*, and the like), occur occasionally. Examples:

kayaténna.	he likes it.
aniá ti pagkayatánna?	why does he like it?
idí kalmán ti panagkayátna.	he liked it yesterday.

6. *MAYÁT*

1. This verb, which has the same meaning as *kayát*, follows the rules of the adjectival construction and is ordinarily invariable. It is a contraction of the prefix *ma* and the stem *ayát*. Examples.

mayátkami.	we are willing.
mayátkayo idí kalmán.	you were willing yesterday.

2. The form *nayát*, for the past, and the forms of the adjectival prefix *ag* (*agmayát*, and the like) occur occasionally. Examples:

nayát a nañgayáb.	he was willing to call him.
kasanó ti panagmayátko?	how can I be willing?

7. *MADÍ*

1. This verb, which means "to be unwilling, to refuse," follows the rules of the adjectival construction and is always invariable. It is probably a contraction of the prefix *ma* and the stem *adí*, as is shown by the form in *ag* of the regular verb *agadí*. Examples:

madí ni Juán.	John refuses.
madí pay láeñg idí kalmán.	he still refused yesterday.

2. The forms of the adjectival prefix *ag* (*agmadí*, and so on) occur occasionally. Examples:

nagmadí.	he refused.
aniá ti pagmadiánna?	why does he refuse?

8. *ITÉD*

1. This verb, which means "to give", may be used, in the substantival construction, either by itself or with the suffix *en* (*itdén*), which has become obsolete. It has only one past form: *intéd*. Examples:

itédmo daytá.	give that.
intédna kadakámi.	he gave it to us.
itdém kadakám ití aldáw itóy ti kanénmi a patináyon ñga aldáw.	give us today our daily bread.
kait-itédda.	they just gave it.

2. When used with the suffix *an*, it is entirely regular and has a double nominative. Examples:

itdánnak ti birókek.	give me what I look for.
initdánmi ni Juána ti tinápay.	we gave Joan bread.

3. With the forms of the prefix *mañg*, it may lose its initial vowel.

siák ti nañgtéd.	I gave it.
asín ti nañgtedánna?	to whom did he give it?
kaanó ti panañgtédna?	when did he give it?
awán ti mañgitéd.	nobody gives it.

NOTE 22. The stem of this verb is probably *ted*, and its initial *i* is probably the prefix *i* of substantival verbs, as may be inferred from the form *itdán*, with the double nominative. The only difficulty is in the form *itdén*, as the prefix *i* is never combined with the suffix *en;* but, as has been noted above, that form has become obsolete, and is perhaps entirely wrong. The second *i* of *initdán* is probably purely euphonic, as it would be impossible for an Iloko mouth to pronounce *intdán*, or it may be that the *i* is considered as a part of the stem because *ted* is a monosyllable. Compare the verb *umáy*.

9. *IKKAN*

This verb (past: *inikkán*), which means "to give, to put in", includes the special meanings of both the prefix *i* and the suffix *an* of the substantival voice; therefore it may have a double object and, consequently, a double nominative. When a possessive is added to it, the final *an* is considered as a suffix; and, in combinations of prefixes with the suffix *an* (*pañg . . . an*, and the like), the final *an* of the verb takes the place of the suffix. Examples:

ikkám ni Juána ti tinápay.	give Joan bread.
inikkánna ti burnáy ti danúm.	he put water in the jar.
asín ti pañgikkák?	to whom should I give it?
daytóy ti nañgikkánmi.	we put it in this.
maikkántayo ti pannakaammó.	we are given knowledge.
sadíno ti pakaikkánna?	where should it be put?

10. *YEG*

This verb (past: *inyég*), which means "to bring," is regular, if the first letter is considered as the substantival prefix *i*. Examples:

yégmo ditóy.	bring it here.
inyégko.	I brought it.
kaanó ti panañgyégna?	when did he bring it?
mayégminto.	we shall bring it.
nayég idí kalmán.	it was brought yesterday.

11. *PAMAYAN*

1. When this verb means "to think," it is always invariable, except for the final *an*, which is simply a substantival suffix. Examples:

awán pamayák.	I think he is not there.
isú ti immáy pamayánmi.	we thought it was he who came.
masúrotkonto pamayák.	I think I shall be able to follow it.
addá pamayánda.	they think there is some.
bassít a básol daytá pamayányo.	you think that is a small sin.

2. When this verb means "to do things without fervor," it allows the forms of the adjectival prefix *ag*. Example:

agpampamayán ni Juán.	John acts without enthusiasm.

12. *KONA*

1. This verb, which means "to say, to think", is mostly used without any prefix or suffix in the present, in which case it follows the rules of the substantival voice. Its past form is *kinoná*. Examples:

konák n̄ga immáy.	I thought he came.
konána a madí.	he said he won't.
isú ti konáda.	that is what they say.
konák n̄ga addá.	I say that he is there.
si asínoak ti koná dagití táo?	who do the men say I am?
kinonámi n̄ga awán.	we thought he was not there.
kastá ti kinonáda.	they said so.

2. When used in the adjectival voice, it allows the forms of the prefix *ag*. Examples:

addá agkoná.	some people say so.
asín ti nagkoná?	who said so?
pagkonaák a kastá ta awán ti umáy.	I think it is so because nobody comes.
kaanó ti panagkonána?	when did he say so?

3. The substantival form *konaén* for the present, and the forms of the prefix *ma* and the substantival prefix *pa*, occur occasionally. Examples:

konaén dagití lakáy.	the old men say.
konaénna.	he says.
makoná.	it is said.
makoná daytóy nákemko.	I think (literally: my mind here says).
makonána n̄ga isú.	he says it is he.
pakpakonák.	I talk at random.

13. *KANÓ*

This verbal form, which translates the latin "dicitur", "it is said, they say", always stands by itself and allows no prefixes, infixes, or suffixes, nor any addition of pronouns, nor any connection by ligatures. It ordinarily follows the first word of the sentence it determines; however, sometimes it appears further down the sentence. When *koná* and *kanó* are used together, the latter always follows. Examples:

awán kanó.	he is not there, they say.
immáyda kanó.	they say that they came.
addá kanó táo idiáy baláy.	there is a man in the house, they say.
isú kanó ti napán nagtákaw.	it is said that it was he who went to steal.
ti kanó lakáy ti immáy.	it is said that it was the old man who came.
ket idí nagánida kanó addá nakítada ñga úleg.	and when they gathered the harvest, they say, they saw a snake.
wen konána kanó.	he said: "yes," they say.

14. *AMMÓ*

The verbs formed with this stem are regular except in one case: when it means "to know", *ammó* may be used without any prefix or suffix, and then it follows the rules of the substantival voice, and remains invariable in both the present and the past tenses. Examples:

ammók.	I know it.
awán ti ammómi.	we know nothing.
addá táo ditóy ket ammóyo.	there is a man here and you know it.
ammók idí.	I knew it formerly.
ammóna idí kalmán.	he knew it yesterday.
ammóda a dákes ket inarámidda met láeñg.	they knew it was bad and still they did it.

15. *MATÚROG*

I. This verb, which means "to sleep", generally retains its adjectival prefix *ma* as a part of the stem in reduplications and combinations with other prefixes. If the prefix *ma* is dropped, it generally allows the forms of the prefix *ag* (*pag . . . an*, and the like) or the infix *um* (*pa . . . en*). Examples:

matúrogkami.	we sleep.
napán nagmatúrog daydí lakáy.	that old man went to sleep.
saán ñga agpakatúrog ti ubíñg.	the child does not allow one to sleep.
matmatúrogda.	they are sleeping.
awán ti pagturóganda.	they have no place where to sleep.
paturógem idá.	make them sleep.

II. 1. Its frequentative is *mannatúrog*, instead of *mannakaturog*. Example:

mannatúrogkayo.	you are great sleepers.

2. The form for the manner how and the time when one sleeps is *pannatúrog*, instead of *pannakaturog*. Example:

kasanó ti pannatúrogmi ditóy?	how can we sleep here?

16. *PATÁY*

I. A. The verbs formed with this stem, which means "death", are regular in most of their forms. Examples:

agpatáy.	he faints.
agpapátay.	he commits suicide.
ni patáy.	death (personified).
aginpapatáy.	he simulates death.
díka mamapátay.	do not kill.
patayém.	kill him.

B. The following forms are irregular:

1. *Matáy* (past: *natáy*), to die, is a contraction of the adjectival prefix *ma* and the stem *patáy*. Examples:

matáyak.	I die.
natáy idi kalmán.	he died yesterday.
addá minatáymi.	we have a dead person (in the house).
dagiti nainatáy.	the dead.

2. The form for the place of death is *pakatayán* (past: *nakatayán*).

idiáyto ti pakatayám.	you will die there.
sadín ti nakatayánna?	where did he die?

3. The form for the manner how and the time when one dies is *ipapatáy*, instead of *pannakatáy* or *pannakapatáy;* these latter forms are sometimes used to render the word "death". Examples:

napintás ti ipapatáyda.	they died beautifully.
kaanó ti ipapatáyna?	when did he die?
ti pannakatáy.	death.
ti pannakapapatáy.	death.

II. The accentuation of the forms of this verbal stem seems very confusing at first, although the rule is very simple: whenever the prefix *pa* enters the composition of the word, the penult of the stem bears the accent (7 to 13, below); else, the last syllable (1 to 6, below). If the original open syllable is redupli-

cated and no prefix *pa* added, the last syllable bears the accent and our rule stands (5 to 6, below).

The only difficulty lies in the fact that the initial open syllable of the stem is *pa;* but, when the word means "to die", the *pa* is simply a reduplication (5 to 6, below), while, when it means "to kill," the *pa* is a prefix (7 to 13, below). Examples:

1. *matáy.*	he dies.
2. *ditóy ti nakatayánda.*	they died here.
3. *pumatáy.*	he threathens killing.
4. *patayénna.*	he kills him.
5. *ti ipapatáymi.*	our death.
6. *ti panagpapatáy.*	mortality.
7. *nagpapátay.*	he committed suicide.
8. *ti panagpapátay.*	suicide.
9. *nagpapapátay.*	he ordered murder.
10. *isú ti namapátay.*	he was the murderer.
11. *papapátayda.*	they have him killed.
12. *napapátay idí kalmán.*	he was killed yesterday.
13. *napapátayna.*	he had him killed.

17. *ALÉG*

This verb, which means "to hasten", and the like, is used only in some districts.

1. When used without reduplication, it ordinarily has no prefix or suffix in the present, and then it follows the rules of the substantival voice. Its past is *inalég.* Examples:

alégmo ti magná.	walk quickly.
alégmo ti agsúrat.	write quick.
inalégko daytá.	I did it in a hurry.

2. When used with the reduplication of the first syllable (*al-alég*), it allows the forms of the adjectival prefix *ag,* the substantival suffix *en,* the substantival prefix *i,* and the like; sometimes, however, these forms are used without reduplication of the stem. Examples:

al-alégmo.	be quick.
díka ammó ti agal-alég.	you do not know how to be quick.
al-algém.	hurry him.
inal-alégko.	I hurried him.
yal-alégmo.	be quick.
agalég.	he is in a hurry.

DIFFUSION CHARACTERISTICS OF SOME PHILIPPINE VEGETABLE TANNING EXTRACTS

By Luz Baens, Leon G. Alejo, and V. G. Lava

Of the Bureau of Science, Manila

TWELVE TEXT FIGURES

This paper is a continuation of the work this bureau has been doing recently on Philippine tanning materials.(1-3, 17, 18)

The tanning process consists essentially in treating the hide or skin with something that will penetrate or diffuse into the hide, and later fix, or combine chemically with the hide substance (collagen).

A study of the most appropriate conditions for the diffusion of tanning liquors into hides is therefore of basic importance for the manufacture of leather.

Collagen is the principal constituent of hides. In physical properties collagen resembles gelatin. In fact, when collagen is heated with water at 70° C., it passes into solution as gelatin. Hofmeister(7) suggests that collagen is an anhydride of gelatin.

This report gives the results of diffusion experiments as affected by changes of acidity and time of contact between tannin extracts and gelatin.

Both Philippine and foreign vegetable tanning extracts were used in this work, in order to compare the relative diffusion characteristics of these different materials.

The Philippine extracts were obtained from plants that are extensively distributed in the Philippines. They all contain commercial quantities of tannin.(2)

EXPERIMENTAL PROCEDURE

The following Philippine materials were used: *a, anabiong, bitaog, kalumpit,* and *kariskis* barks gathered from trees growing near Los Baños, Laguna Province; aqueous extracts were prepared from these barks, and adjusted to contain 2 per cent of total solids.

Anabiong (*Trema orientalis* Blume)(14) is a medium-sized tree, reaching a diameter of 30 to 40 centimeters. The bark is characterized by a white appearance due to the presence of lichens. Anabiong is found throughout the Philippines at low and medium altitudes. It grows very abundantly in deserted clearings and second-growth forests. The bark is a source of tannin, and being stringy it is also used as twine.(6) In Batangas Province it is also used for dyeing clothes and fish nets.

Bitaog (*Calophyllum inophyllum* Linn.)(9, p. 260) or *palo maria de la playa,* is widely distributed throughout the Philippines along seashores and banks of streams at low and medium altitudes. A fair number is growing in Bataan, Zambales, and Mindoro Provinces. The tree is large and reaches a diameter of 130 centimeters.

Kalumpit (*Terminalia edulis* Blanco) (9, p. 371) is widely distributed from Northern Luzon to Mindanao and Palawan, in most provinces and islands in the more open portions of the dipterocarp forests at low and medium altitudes. It is not abundant anywhere. It is a large tree that reaches a diameter of 100 centimeters.

Kariskis [*Albizzia lebbekoides* (DC) Benth.] (9, p. 115) is a small tree widely distributed throughout the Philippines at low and medium altitudes.

b. The solid extracts were prepared in our laboratory from the kernels of green betel-nut fruits obtained from Los Baños, Laguna Province, and from the bark of black wattle grown at the Philippine Bureau of Forestry Experimental Station in Bukidnon Province, Mindanao.

Betel palm (*Areca catechu*),(4) known in the Philippines as *boñga, buñga,* or *luyos,* usually reaches a height of 40 to 100 feet and a circumference of about 20 inches. The fruit is 1.5 to 2 inches long, smooth, and orange or scarlet when ripe. This palm is cultivated within the moist tropical tracts along the coast of eastern and western Bengal, India, and in some portions of Assam and Ceylon. It has been cultivated extensively in all parts of the East Indies and found growing wild in some parts of the Philippines and Sumatra.

The palm bears fruit throughout the year. Flowers form in January and March, and the fruits ripen in October, December, and January. A tree usually bears fruit at the age of 6 to 7 years. Each tree produces two bunches of fruits and sometimes three or four. A good bunch gives 200 to 300 nuts.

The nut, together with betel pepper leaf and lime, is used for chewing. Medicinally it is used as an astringent, especifically for diarrhœa. In some parts of India it is used for dyeing cotton cloth. It is also used as a vermifuge.

The black wattle (*Acacia decurrens*) (2) bark used in the preparation of the tanning extract was obtained from trees grown in Bukidnon Province, Mindanao. The trees growing at sitio Kaatoan reached an average height of 5.29 meters at the age of about 4 years. These trees were grown from seeds obtained from the Forest Research Institute, Buitenzorg, Java.

c. Kamachile and *bakauan* extracts were obtained from the Philippine Cutch Corporation in Zamboanga city.

Kamachile [*Pithecolobium dulce* (Roxb.) Benth.] (5, p. 293) is a tree 5 to 8 meters high. It is a native of tropical America but is now thoroughly naturalized in the Philippines. It is common and widely distributed.

Bakauan (*Rhizophora candelaria* DC) (9, p. 361) grows abundantly throughout the Philippine swamps. It occupies nearly a dominant role in littoral forests. It is planted in the swamps of Rizal, Bulacan, Pampanga, and Bataan Provinces, where there are fish ponds, for wind breaks and for protection against sea waves. The tree usually reaches a diameter of 50 centimeters.

d. Bunot extract is an alkaline liquid that was obtained in the Bureau of Science as a by-product in the preparation of wall boards from coconut husk. Bunot contains more dye than tannin.

Coconut (*Cocos nucifera* Linn.) (5, p. 93) is the most abundant and most valuable palm in the Philippines. It is cultivated in most parts of the Islands for copra or coconut oil. It thrives well on the seashore and in places where there is an equal distribution of rain throughout the year. The husk of the fruits is used for ropes, hats, mats, brushes, and brooms.

The American tanning materials were standard products imported from American companies as shown in Table 1.

TABLE 1.—*Materials used for diffusion experiments.*

Sample.	Name.		Nature of sample.	Source.
	Common.	Scientific.		
[a] 1	Tanolin		Chrome (solid)	Martin Dennis, New Jersey.
[b] 2	Anabiong	*Trema orientalis* (Linn.) Bl.	Solution from bark.	Los Baños, Laguna, Philippines.
[b] 3	Bitaog	*Calophyllum inophyllum* Linn.	do	Do.
[b] 4	Kalumpit	*Terminalia edulis* Blco.	do	Do.
[b] 5	Kariskis	*Albizzia lebbekoides* (DC) Benth.	do	Do.
[b] 6	Bunot—coconut husk.	*Cocos nucifera*	Liquid extract	Bureau of Science, Manila.
[b] 7	Kamachile	*Pithecolobium dulce* (Roxb.) Benth.	Solid extract	Philippine Cutch Corporation, Zamboanga, Philippines.
[b] 8	Cutch—baka-	*Rhizophora candelaria* DC	do	Do.
[b] 9	Betel nut	*Areca catechu*	do	Bureau of Science, Manila.
[b] 10	Black wattle	*Acacia decurrens* Willd.	do	Do.
[c] 11	Do	do	do	The Tannin Corporation, New York, New York.
[c] 12	Quebracho	*Quebrachia lorzentzii*	do	Do.
[c] 13	Mytan—myrobalan.	*Terminalia chebula*	Semisolid extract.	Do.
[c] 14	Valonex—valonia.	*Quercus aegilops*	Solid extract	Do.
[c] 15	Hemlock	*Tsuga canadensis*	Powdered extract.	Mead Paperboard Corporation, Lynchburg, Virginia.
[c] 16	Red oak	*Quercus rubra*	do	Do.
[c] 17	Chestnut	*Castanea dentata*	Solid extract	The Champion Paper & Fiber Co., Hamilton, Ohio.

[a] An imported chrome preparation.
[b] Philippine vegetable tanning materials.
[c] Imported vegetable tanning materials.

These imported extracts(15) are usually prepared from the barks of black wattle (*Acacia decurrens*); hemlock (*Tsuga canadensis*); and chestnut (*Castanea dentata*); from the wood of quebracho (*Quebrachia lorzentzii*); from the nuts of myrobalan (*Terminalia chebula*); from the acorns of valonia (*Quercus aegelops*); and from the twig galls of red oak (*Quercus rubra*).

According to Rogers(10) hemlock is an excellent tanning material, and probably the only one that could possibly produce excellent leather of all kinds. It is well suited for the lightest colored fancy or upper leather as well as for the heaviest soles.

Chestnut has been used extensively in the manufacture of sole, belting, and other heavy leathers. Properly prepared and used, it can also be employed for many other classes of leather.

Quebracho is employed for all classes of leather. When clarified it is especially suited for the tannage of light leathers,

where weight and plumpness are not considered. Combined with hemlock and oak, it is extensively used in the manufacture of bag, case, patent, and automobile leather. For heavy leather, such as sole, belting, and harness, quebracho, used alone, is not a good tanning material, because it does not contain the necessary sugars for acid-forming which is essential for this particular tannage. When used alone it does not make solid leather of good weight.

Table 2 gives the analyses of these materials in accordance with the official methods of the American Leather Chemists Association.

TABLE 2.—*Analyses of materials.*[a]

Sample.	Common name.	Tannin.	Nontannin.	Solids.		
				Total.	Soluble.	Insoluble.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
[b] 1	Tanolin					
[c] 2	Anabiong	11.72	11.88	29.37	24.60	4.77
[d] 3	Bitaog	16.05	4.96	22.68	21.01	1.67
[d] 4	Kalumpit	34.11	7.23	43.17	41.34	1.83
[d] 5	Kariskis	19.70	7.63	28.12	27.33	0.79
[e] 6	Bunot—coconut husk	0.39	1.90	2.30	2.29	0.01
[f] 7	Kamachile	57.45	33.85	92.88	91.30	1.58
[f] 8	Cutch—bakauan	62.70	28.30	92.36	91.00	1.36
[f] 9	Betel nut	56.88	28.20	98.43	85.08	13.35
[f] 10	Black wattle	67.37	17.42	88.02	84.79	3.23
[f] 11	Do	64.93	19.43	84.59	84.36	0.23
[f] 12	Quebracho	67.21	17.10	90.64	84.31	6.33
[f] 13	Mytan—myrobalan	45.00	26.69	80.95	71.69	9.26
[f] 14	Valonex—valonia	59.13	29.39	90.90	88.52	2.38
[f] 15	Hemlock	58.37	27.80	89.90	85.17	4.73
[f] 16	Red oak	46.91	35.80	87.82	82.71	5.11
[f] 17	Chestnut	59.74	26.38	88.39	86.12	2.27

[a] All of the samples in this table except sample 1 (tanolin) are vegetable tanning materials analysed according to the methods of the American Leather Chemists Association.

[b] Contained 12 per cent of moisture; 38.6 per cent of SO_3; 3.9 per cent of Al_2O_3; 7.9 per cent of Na_2O; and 23 per cent of Cr_2O_3 (26 per cent dry basis).

[c] Analyzed in our laboratory and the results computed on a dry basis.

[d] From Baens, L., F. M. Yenko, and A. P. West. Tannin contents of Philippine barks and wood. Philip. Journ. Sci. 55 (1934) 180.

[e] Computed on the volume of the sample.

[f] Computed on a wet basis.

Gelatin was used for the diffusion experiments, and the jelly was prepared according to the procedures of Thomas(12) and of Wilson and Kern.(16)

A 10 per cent dispersion of gelatin in a warm 0.2 M tartaric-acid solution was prepared, and 0.2 per cent crystallized ferric chloride dissolved in the dispersion. Portions of this gelatin dispersion (10 cc each) were measured into separate

sets of test tubes. Different amounts of sodium hydroxide (0.5 N) solution were added to each set of test tubes, and the dispersions diluted with distilled water so that each tube contained 5 per cent of gelatin and 0.1 per cent of ferric chloride. In this way gelatin jellies of different pH values were prepared. The tubes were placed in a refrigerator, and after one week, one tube from each set was allowed to stand for about one hour at room temperature, and the pH determined with the glass electrode.

Solutions of the tanning extracts containing equal amounts of total solids and having pH corresponding to those of the different jelly tubes were prepared as follows: Solutions containing 2 per cent total solids were first prepared and 10-cc portions of these poured into glass-stoppered bottles. Different quantities of tartaric acid (0.2 M) or sodium hydroxide (0.5 N) were added to each bottle in order to make pH values approximately equal to those of the gelatin tubes. The solutions were then diluted with water so that the final solutions contained 1 per cent of total solids. After a week the pH values of these solutions were determined.

Five cc of these tan solutions having definite pH values were poured into the solid gelatin tubes which had the corresponding pH values. The depths of penetration of the tan liquor into the gelatin jelly, as indicated by the end of the dark zones (brown, violet, or blue), were recorded at various intervals (7, 16, 25, 38, and 48 days).

DISCUSSION OF RESULTS

Tables 3 to 19 show the extent of diffusion of the different tanning materials in gelatin jelly at different pH values and at different periods of contact between tan liquor and gelatin jelly. In all these tables column 1 gives the number of the sample corresponding to the pH used; column 2 gives the pH of the gelatin jelly in the test tubes; column 3 gives the pH of the tannin solution before contact with the gelatin jelly. Columns 4, 5, 6, 7, and 8 give the depths of penetration of the liquor into the gelatin jelly after 7, 16, 25, 38, and 48 days respectively.

The relation between the extent of diffusion and the pH of the tanning extract after 7 days is shown in text figs. 1 to 4; after 16 days in text figs. 5 to 8; and after 48 days in text figs. 9 to 12.

Tables 3 to 19 and text figs. 1 to 12 show that the different tans studied have their characteristic rates of diffusion at different pH values and after different periods of contact between the gelatin jelly and the tan liquor.

Hoppenstedt,(8) working with some vegetable tans, noted the order of increasing rate of diffusion among his tanning extracts as follows: Mangrove bark <quebracho <hemlock bark <algarobilla <valonia <oak bark <myrobalan <chestnut wood

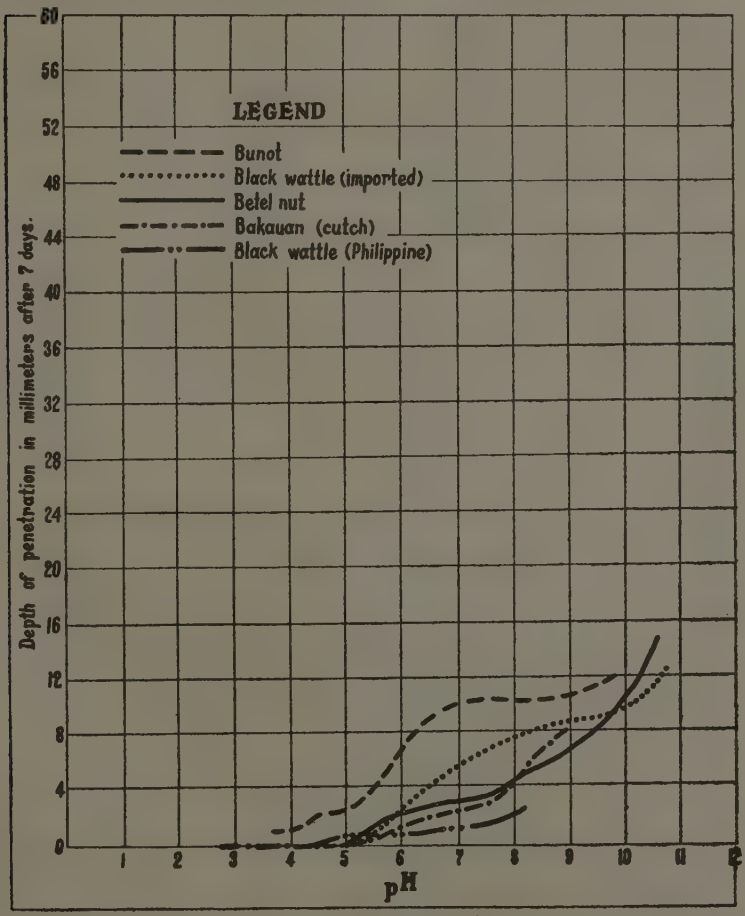

FIG. 1. Penetration of bunot, imported black wattle, betel nut, bakauan (cutch), and Philippine black wattle tanning extracts in 7 days with increasing pH.

<gambier <divi-divi <sumac. Thus mangrove bark gave the lowest rate of diffusion while sumac gave the highest.

Working with another set of vegetable tans, and considering that, since tannins react with gelatin to form insoluble com-

pounds, while nontans do not, a comparative measure of the content of nontannins in extracts could be indicated by their diffusion in gelatin jelly, Thomas(12) showed that the order of diffusion of the nontannins used by him is as follows:

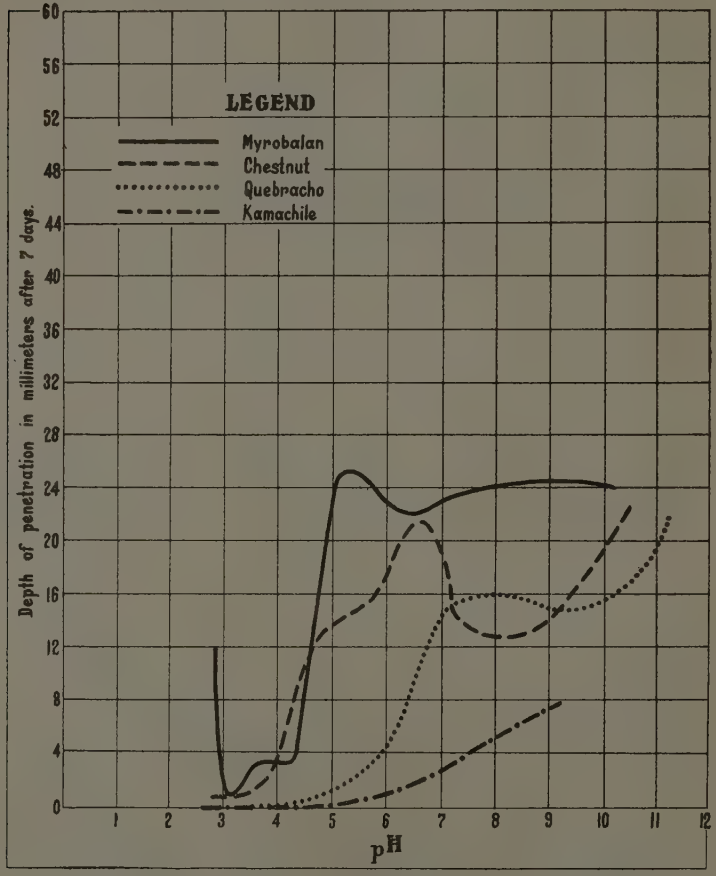

FIG. 2. Penetration of myrobalan, chestnut, quebracho, and kamachile tanning extracts in 7 days with increasing pH.

Osage orange <quebracho <hemlock bark <larch bark <oak bark <chestnut wood <gambier <sumac. The nontans in osage orange gave the lowest diffusion while those in sumac gave the highest.

Thomas observed that the rate of diffusion of tanning extracts into gelatin jelly is generally greater the greater the ratio of nontanin to tannin in the extract; also that the order for the increasing rate of diffusion is the same for the decreasing astrin-

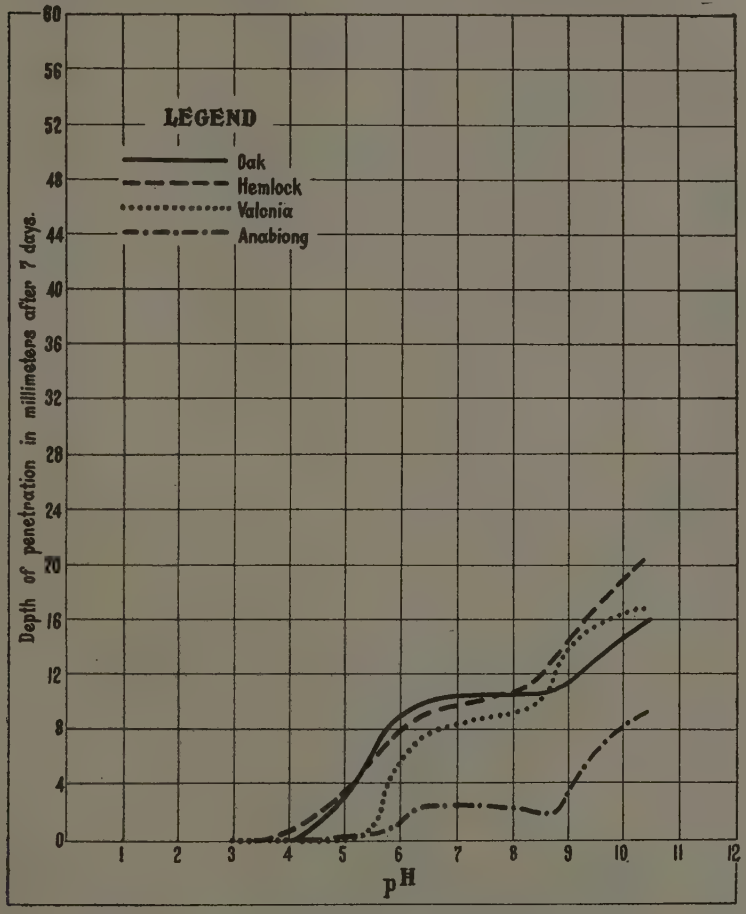

FIG. 3. Penetration of oak, hemlock, valonia, and anabiong tanning extracts in 7 days with increasing pH.

gency or rate of combination of the hide and tanning material. As explained by Wilson and Kern, tannins and nontannins both form compounds with hide substance. But tannins not only have high molecular weights and are, therefore, slow-moving, but they also form stable compounds with hide substance; while nontan-

nins have low molecular weights and, therefore, move faster, and form highly dissociated compounds with hide substance. Hence tannins that would otherwise have combined with hide sub-

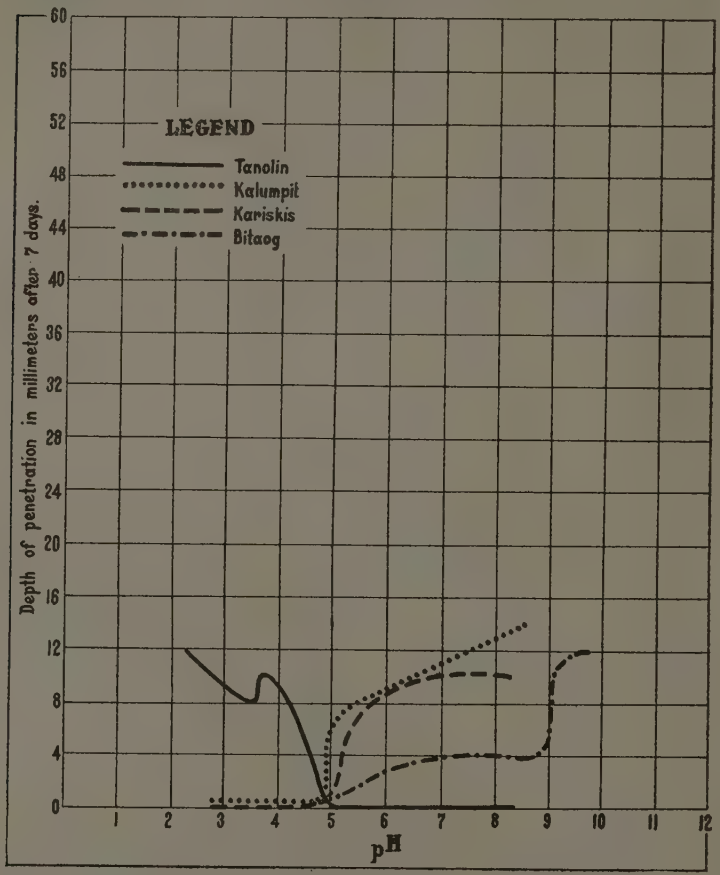

FIG. 4. Penetration of tanolin, kalumpit, kariskis, and bitaog tanning extracts in 7 days with increasing pH.

stance near the surface of the hide could not do so because of the previous occupation of this space by nontannins. In this way the tannins are enabled to proceed into the interior of the hide with an increased rate of penetration.

Furthermore, Wilson and Kern predicted that on the basis of the Procter-Wilson theory of vegetable tanning(13) both the

tannin and nontannin constituents would penetrate hide substance more rapidly if the acidity of the tan liquor is brought

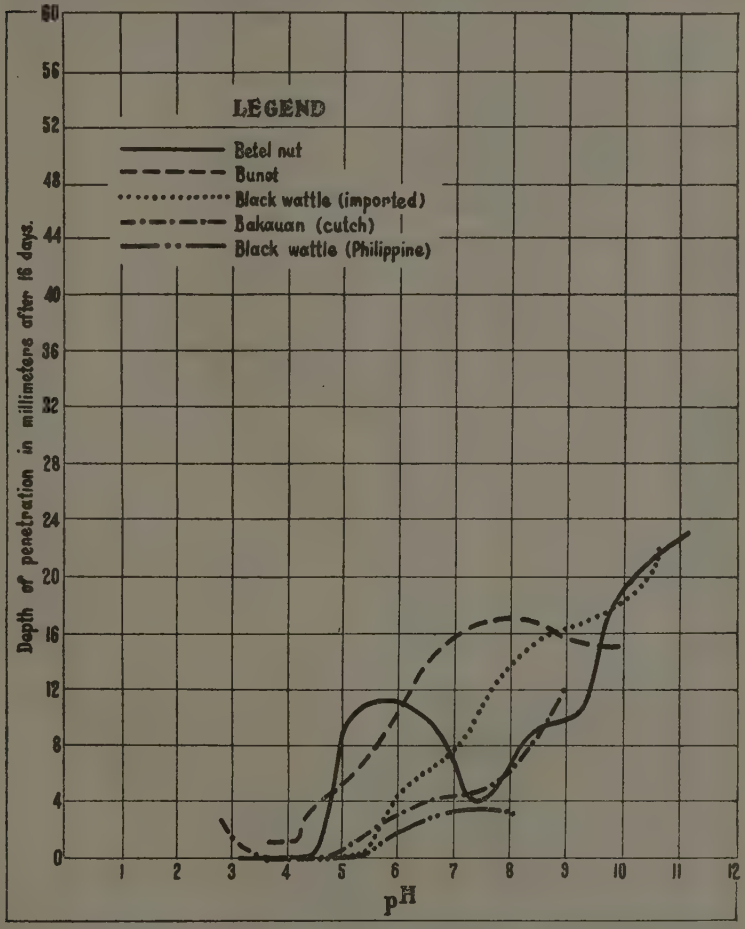

FIG. 5. Penetration of betel-nut, bunot, imported black-wattle, bakauan (cutch), and Philippine black-wattle tanning extracts in 16 days with increasing pH.

to the isoelectric point of the hide substance, and they showed that the rate of penetration is definitely a function of the pH of the tan liquor and the gelatin jelly.

In tanning practice, in general, if the pH of a vegetable tan liquor goes above 5, the yield of leather is low and the leather is colored. On the other hand, if the pH of the liquor goes below 3 with the use of free acids, the liquor astringency is

greatly increased, the tannins are fixed rapidly in the surface, and their rate of penetration is decreased. Furthermore, the

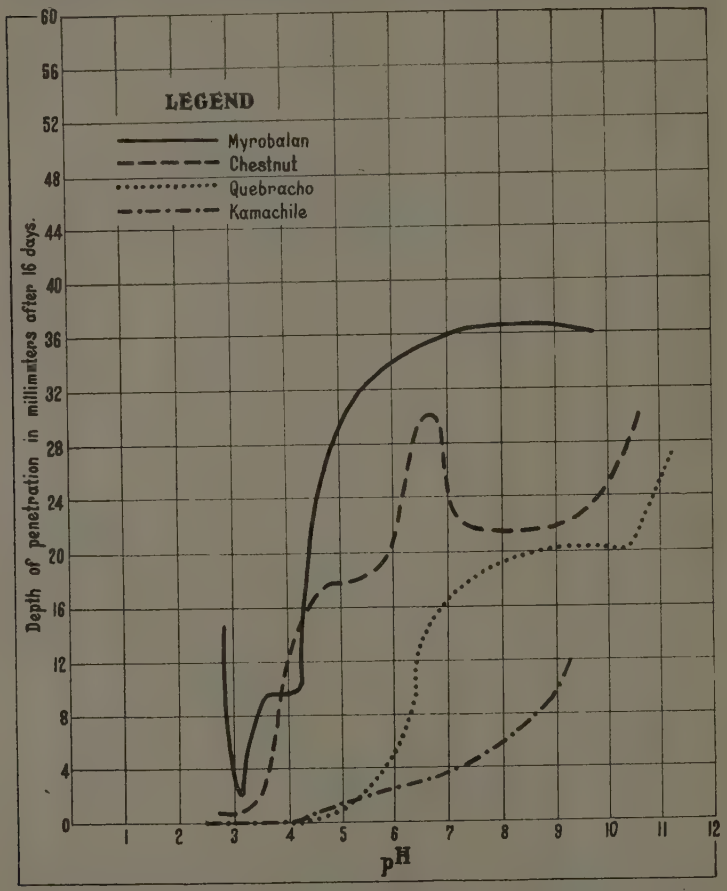

FIG. 6. Penetration of myrobalan, chestnut, quebracho, and kamachile tanning extracts in 16 days with increasing pH.

diffusion of the free acid into the middle of the skin produces swelling and distortion of the skin, which are harmful to the finished leather. For this reason syntans are used in conjunction with the astringent vegetable tans in order that their astringency may be decreased and their rate of penetration increased.

For purposes of comparison, therefore, we have classified the tans studied by their rates of diffusion at pH below 3, at the pH range 3 to 5, and at pH above 5. Table 20 shows this classification. It will be noted that among these tans only my-

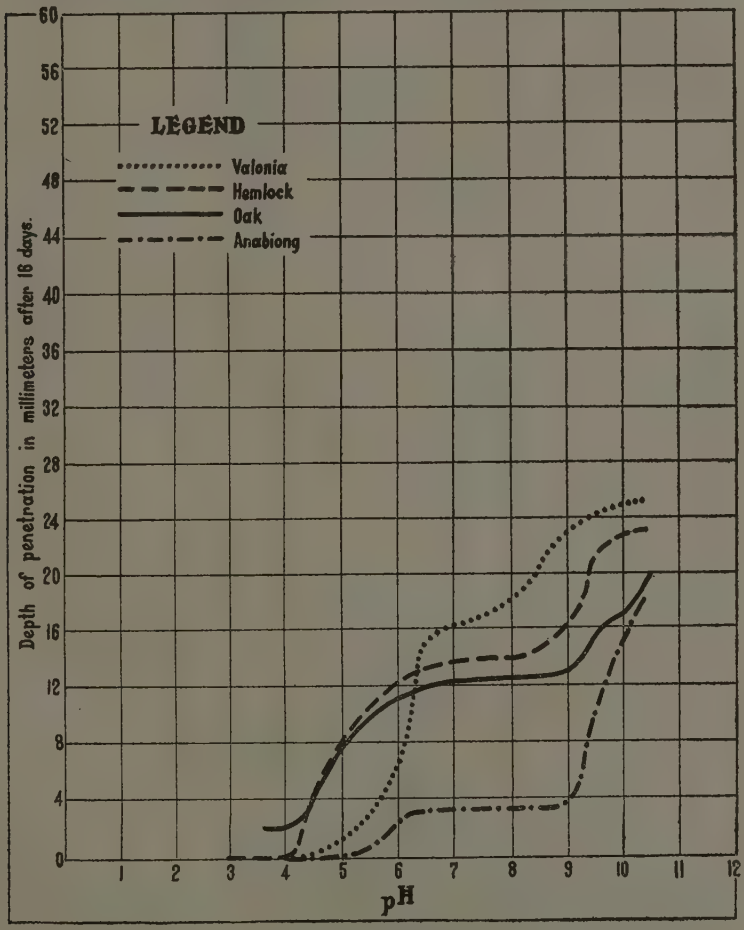

FIG. 7. Penetration of valonia, hemlock, oak, and anabiong tanning extracts in 16 days with increasing pH.

robalan, chestnut, and tanolin show penetration in gelatin jelly after 7 days' contact, when the pH is below 3; cutch, kalumpit, and hemlock show penetration below this pH only after 7 days. The similarity of conditions on the acid range for the utilization

of the vegetable tan, myrobalan, and the chrome tan, tanolin, is very evident.

On the other hand, above pH 5 all of these tans, with the exception of the mineral tanolin, show some degree of penetra-

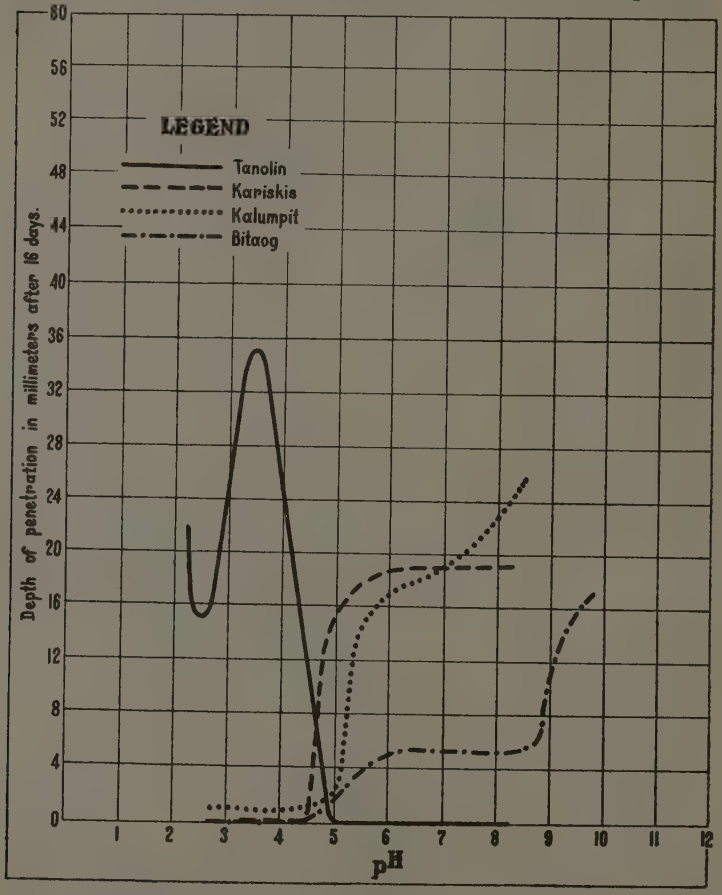

FIG. 8. Penetration of tanolin, kariskis, kalumpit, and bitaog tanning extracts in 16 days with increasing pH.

tion, starting with the most astringent, Philippine black wattle, kamachile, cutch, and the like, and ending with the least astringent, myrobalan and chestnut.

At the pH range 3 to 5, Philippine black wattle, kamachile, cutch, anabiong, imported black wattle, and bitaog show no

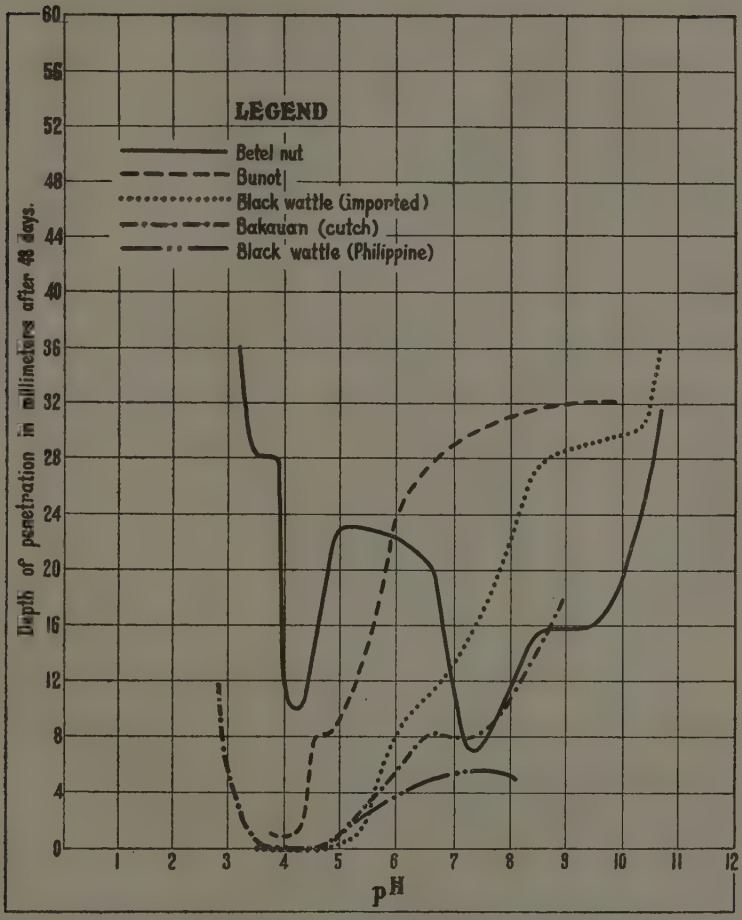

FIG. 9. Penetration of betel nut, bunot, imported black-wattle, bakauan (cutch), and Philippine black-wattle in 48 days with increasing pH.

penetration even after 48 days; while betel nut, quebracho, valonia, kalumpit, hemlock, bunot, kariskis and oak show little penetration, if any, after 7 days, and a greater degree of penetration only after 48 days. Oak, myrobalan, and chestnut show some penetration after 7 days, and a much greater penetration after 48 days.

Taking all these rates of diffusion at different pH ranges into consideration, the order of increasing rate of diffusion of these

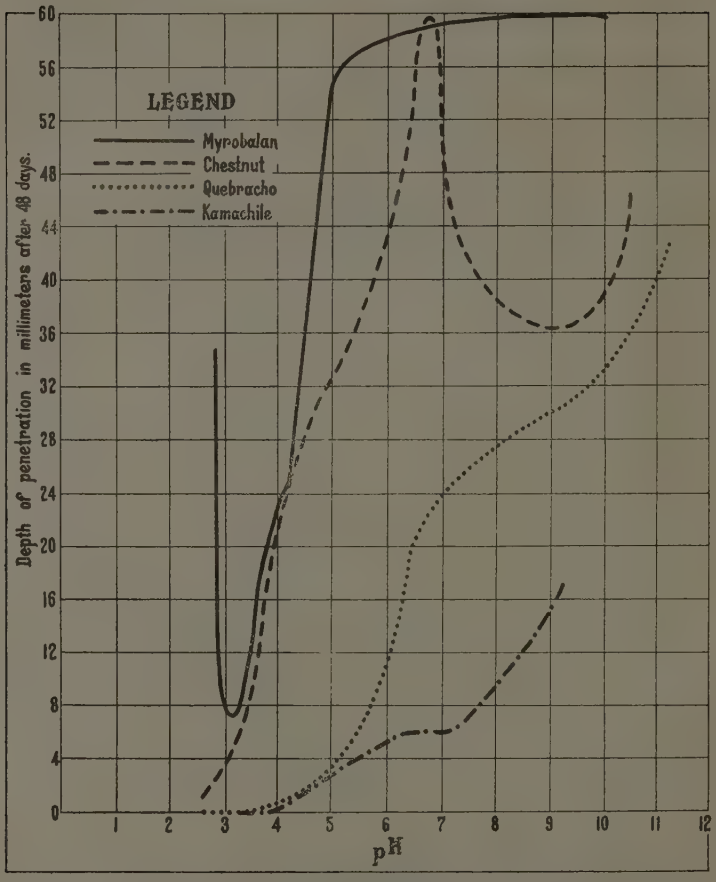

FIG. 10. Penetration of myrobalan, chestnut, quebracho, and kamachile tanning extracts in 48 days with increasing pH.

different tans into gelatin jelly is arranged and given in the last column in Table 20. The Hoppenstedt and Thomas values are included for comparison. Hoppenstedt's and Thomas's orders are identical insofar as they use the same tans, and our order is identical with that of Hoppenstedt, except in the positions of valonia and hemlock, which are reversed in our case. Moreover, Philippine black wattle, kamachile, cutch, anabiong, imported black wattle, and bitaog all come before quebracho;

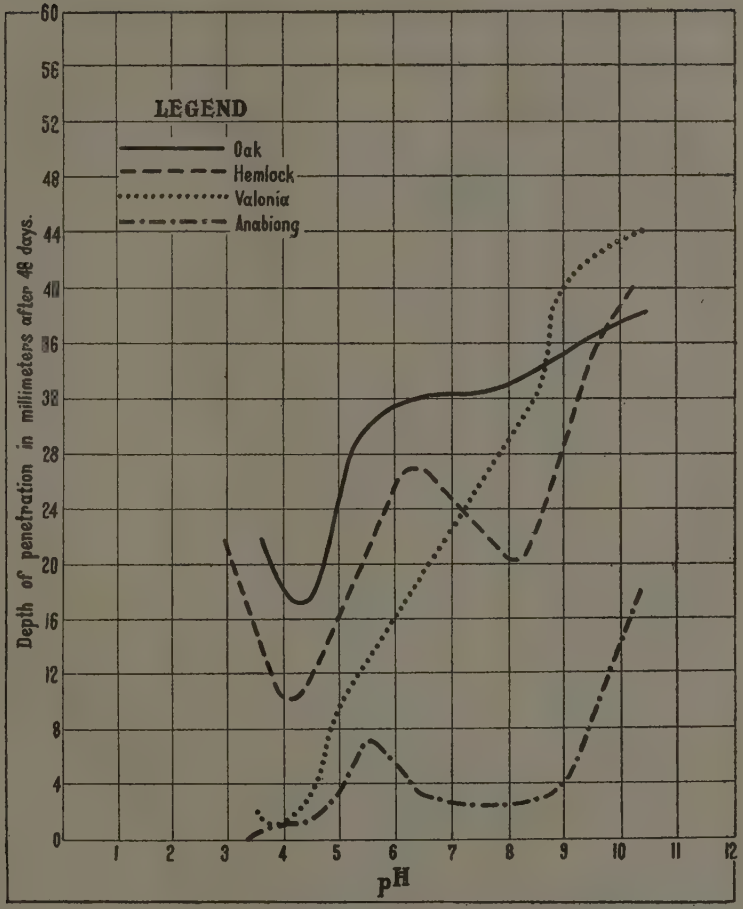

FIG. 11. Penetration of oak, hemlock, valonia, and anabiong tanning extracts in 48 days with increasing pH.

kalumpit comes after valonia and before hemlock; and bunot, kariskis, and betel nut come after hemlock and before oak.

Betel-nut tan extract, in practical tanning with calf skin, yields a very light-colored and soft leather adapted to the manufacture of uppers. Its diffusion characteristics show great similarity with those of oak and hemlock, although it is below imported black wattle after 7 days and above it only after 16 days. The same may be said, to a certain extent, in the case of kariskis and bunot.

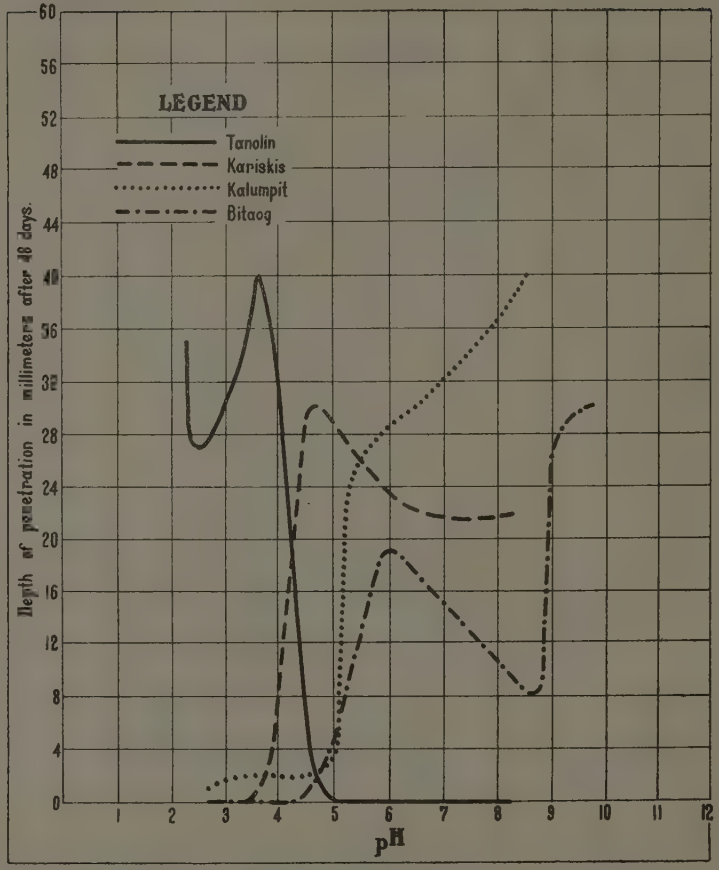

FIG. 12. Penetration of tanolin, kariskis, kalumpit, and bitaog tanning extracts in 48 days with increasing pH.

Comparison of the order of diffusion, as obtained from a classification of the diffusion of the vegetable tans in relation to pH, with the order obtained from the determination of the tannin + nontannin ratios of these tans, shows that there is a great discrepancy between the two, as shown in Table 21. This finding is also in conformity with the observation of Stahler(11) who, studying the penetration of chestnut and quebracho tannins into animal hides through an examination of the frozen sections stained with potassium dichromate, found

TABLE 3.—*Diffusion of tanolin solution in gelatin jelly.*

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	2.2	2.3	12	22	30	35	35
2	2.5	2.5	11	19	25	27	27
3	3.5	3.5	8	35	35	37	37
4	3.7	3.7	10	30	35	40	40
5	4.2	4.1	8	25	25	30	30
6	4.8	5.0	0	0	0	0	0
7	5.9	5.7	0	0	0	0	0
8	6.3	6.5	0	0	0	0	0
9	9.0	8.3	0		0	0	0

TABLE 4.—*Diffusion of anabiong tanning extract in gelatin jelly.*

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	3.5	3.4	0	0	0	0	0
2	3.9	3.9	0	0	0	0	1
3	4.5	4.4	0	0	0	0	1
4	5.0	5.6	Slight	1	2	3	7
5	6.5	6.4	2	3	3	3	3
6	8.8	8.8	2	3	3	3	3
7	9.5	9.3	5	6	6	6	6
8	10.4	10.4	9	18	18	18	18

TABLE 5.—*Diffusion of bitaog tanning extract in gelatin jelly.*

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	2.5	2.7	0	0	0	0	0
2	3.5	3.3	0	0	0	0	0
3	4.5	4.5	0	0	0	0	0
4	6.5	6.0	3	5	8	15	19
5	8.8	8.8	4	6	8	8	8
6	9.5	9.1	10	13	16	27	27
7	9.8	9.8	12	17	20	30	30

TABLE 6.—*Diffusion of kalumpit tanning extract in gelatin jelly.*

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	2.5	2.7	slight	1	1	1	1
2	3.5	3.3	do	1	2	2	2
3	4.5	4.2	do	1	2	2	2
4	4.7	4.9	1	2	3	3	3
5	5.0	5.3	7	12	15	17	25
6	6.5	6.5	10	18	23	26	30
7	8.8	8.5	14	26	30	35	40

TABLE 7.—*Diffusion of kariskis tanning extract in gelatin jelly.*

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	2.5	2.8	0	0	0	0	0
2	3.5	3.4	0	0	0	0	0
3	4.7	4.7	slight	4	14	20	30
4	6.5	6.5	10	19	22	22	22
5	8.8	8.3	10	19	22	22	22

TABLE 8.—*Diffusion of bunot tanning extract in gelatin jelly.*[a]

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	3.5	3.8	1	1	1	1	1
2	4.2	4.3	1	1	1	1	1
3	4.6	4.5	2	4	6	6	8
4	4.8	4.8	2	5	8	8	8
5	5.6	5.6	4	7	10	12	15
6	5.9	6.0	6	10	12	17	22
7	6.3	6.3	8	12	13	20	25
8	6.8	6.7	10	15	20	25	27
9	9.0	8.9	10	16	25	30	32
10	9.5	9.9	12	15	26	30	32

[a] The bunot solution, which was alkaline in reaction, was a by product from experiments on the manufacture of wall boards from coconut husk.

TABLE 9.—*Diffusion of kamachile tanning extract in gelatin jelly.*

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	3.1	3.0	0	0	0	0	0
2	3.7	3.5	0	0	0	0	0
3	4.1	4.0	0	0	0	0	0
4	6.5	6.4	1.5	3	5	6	6
5	7.4	7.2	3	4	5	6	6
6	9.3	9.3	8	12	14	16	17

TABLE 10.—*Diffusion of cutch extract in gelatin jelly.*

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	2.6	2.9	0	3	6	11	12
2	3.7	3.5	0	0	0	0	0
3	4.7	4.7	0	0	0	0	0
4	6.5	6.6	2	4	5	7	8
5	7.4	7.6	2.5	5	7	7	8
6	9.3	9.0	8	12	14	17	18

TABLE 11.—*Diffusion of betel-nut tanning extract in gelating jelly.*[a]

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	3.1	3.1	0	0	0	30	36
2	3.7	3.5	0	0	0	20	28
3	4.1	3.8	0	0	0	20	28
4	4.5	4.3	0	1	2	5	10
5	5.1	5.0	0	10	18	22	23
6	6.5	6.6	3	10	12	20	20
7	7.4	7.3	3	4	5	6	7
8	8.5	8.5	6	9	9	14	15
9	9.3	9.5	8	10	13	14	16
10	9.8	10.4	12	18	20	22	25
11	11.2	10.7	15	23	23	30	32

[a] The betel-nut extract was prepared in the Bureau of Science from the kernels of green betel fruits gathered in Los Baños, Laguna Province.

TABLE 12.—*Diffusion of Philippine black-wattle tanning extract in gelatin jelly.*[a]

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	3.7	3.6	0	0	0	0	0
2	4.2	4.0	0	0	0	0	0
3	4.6	4.7	0	0	0	0	0
4	5.5	5.3	slight	slight	1	1	1
5	5.6	5.7	1	1	2	2	3
6	6.3	6.1	1	2	3	3	4
7	8.9	8.2	2	3	5	5	5

[a] The black wattle solid tannin extract was prepared in the Bureau of Science from black wattle grown in Bukidnon Province, Mindanao, by the Philippine Bureau of Forestry.

TABLE 13.—*Diffusion of imported black-wattle tanning extract in gelatin jelly.*

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	3.5	3.6	0	0	0	0	0
2	4.2	4.2	0	0	0	0	0
3	4.8	4.7	0	0	0	0	0
4	5.6	5.4	0	0	slight	slight	1
5	6.3	6.2	3	5	7	7	10
6	7.5	7.3	6	9	14	16	16
7	9.0	8.3	8	15	22	25	27
8	10.2	10.4	10	19	24	30	32
9	10.8	10.7	13	22	27	32	36

TABLE 14.—*Diffusion of quebracho tanning extract in gelatin jelly.*

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	2.6	2.7	0	0	0	0	0
2	3.7	3.6	0	0	0	0	0
3	5.1	5.0	1	1	1	2	3
4	6.5	6.4	7	10	14	16	19
5	7.4	7.1	15	17	20	23	24
6	9.3	9.1	15	20	22	26	30
7	10.5	10.5	16	20	27	29	35
8	11.3	11.3	22	27	31	39	42

TABLE 15.—*Diffusion of myrobalan tanning extract in gelatin jelly.*

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	2.6	2.9	12	15	25	30	35
2	3.1	3.1	1	2	3	5	7
3	3.7	3.6	3	10	11	13	16
4	4.1	4.3	3	10	15	20	25
5	5.1	5.1	25	30	40	47	55
6	6.5	6.5	22	35	40	47	55
7	7.4	7.0	23	36	40	47	55
8	9.3	9.8	24	36	44	48	60
9	10.5	10.0	24	36	44	49	60

TABLE 16.—*Diffusion of valonia tanning extract in gelatin jelly.*

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	3.5	3.5	0	0	0	1	2
2	3.9	3.9	0	0	0	0	1
3	4.5	4.5	0	slight	2	3	3
4	5.0	5.3	0	2	4	10	11
5	6.5	6.4	7	14	15	20	20
6	8.8	8.5	10	20	23	30	32
7	9.5	9.0	14	23	28	37	40
8	10.4	10.5	17	25	35	43	44

TABLE 17.—*Diffusion of hemlock tanning extract in gelatin jelly.*

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	2.5	3.0	0	0	0	4	22
2	3.5	3.5	0	0	0	2	15
3	4.5	4.2	slight	slight	2	4	10
4	6.5	6.4	9	13	17	25	27
5	8.8	8.2	11	14	18	20	20
6	9.5	9.5	17	21	27	32	35
7	10.4	10.3	20	23	30	37	40

TABLE 18.—*Diffusion of red-oak tanning extract in gelatin jelly.*

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	3.5	3.7	0	2	2	13	22
2	4.5	4.4	2	3	3	10	17
3	5.0	5.6	6	10	20	27	30
4	6.5	6.4	10	12	22	28	32
5	8.8	9.0	11	13	22	28	35
6	9.5	9.4	13	15	24	28	36
7	9.8	9.9	14	17	25	30	37
8	10.4	10.5	16	20	28	33	38

TABLE 19.—*Diffusion of chestnut tanning extract in gelatin jelly.*

Sample.	pH.		Depth of penetration with days of contact.				
	Gelatin tube.	Tannin solution.	7	16	25	38	48
			mm.	*mm.*	*mm.*	*mm.*	*mm.*
1	2.6	2.7	1	1	1	1	1
2	3.1	3.2	1	1	2	4	5
3	3.7	3.9	2	8	10	14	16
4	4.7	4.9	13	18	21	28	31
5	5.1	5.6	15	20	25	32	37
6	6.5	6.8	21	30	42	52	60
7	7.4	7.2	15	22	30	40	44
8	9.3	9.3	15	22	30	33	36
9	10.5	10.6	23	30	35	40	47

TABLE 20.—*Order of increasing rate of diffusion of different tan liquors.*

Tanning extract.	Penetration at pH below 3.		Penetration at pH between 3 and 5.		Penetration at pH above 5.		Penetration range in mm and pH above 5.		Order of increasing rate of diffusion.			
	After 7 days.	After 48 days.	After 7 days.	After 48 days.	After 7 days.	After 48 days.			Hoppen-stedt.	Thomas.	Our results.	
											Relative.	Absolute.
	mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*pH.*				
Philippine black wattle			0	0	1 – 5	1– 5	1 – 5	5.6– 8.5			—2	1
Kamachile			0	0	1.5– 8	6–17	1.5–17	6.4– 9.3			—1	2
Cutch	0	12	0	0	2 – 8	8–18	2 –18	6.5– 9.1	0		0	3
Anabiong			0	0– 1	0 – 9	7–18	0 –18	5.3–10.4			0a	4
Imported black wattle			0	0	0 –13	1–36	0 –36	5.5–10.7			0b	5
Bitaog	0	0	0	0	3 –12	19–30	3 –30	6.2– 9.8			0c	6
Quebracho	0	0	0– 1	0– 3	1 –22	3–42	1 –42	5.0–11.3	1	A	1	7
Valonia			0	2– 3	0 –17	11–44	0 –44	5.1–10.4	3		2	8
Kalumpit	0	1	0– 1	2– 3	7 –14	25–40	7 –40	5.1– 8.6			2a	9
Hemlock	0	22	0	15–10	9 –20	27–40	9 –40	6.4–10.4	2	B	3	10
Bunot			1– 2	1– 3	4 –12	15–32	4 –32	5.6– 9.7			3a	11
Kariskis	0	0	0	30	10	22	10 –22	6.5– 8.5			3b	12
Betel nut			0	36–10	0 –15	23–32	0 –32	5.0–10.4			3c	13
Red oak			0– 2	22–17	6 –16	30–38	6 –38	5.3–10.4	4	C	4	14
Myrobalan	12	35	1– 3	7–25	25 –24	55–60	25 –60	5.1–10.2	5		5	15
Chestnut	1	1	1–13	5–31	15 –23	37–60	15 –60	5.3–10.5	6	D	6	16
Tanolin [a]	12–11	35–27	8– 0	37– 0	0	0	0	4.9– 8.6			7	17

[a] Not a vegetable ton.

that penetration was not changed by increasing the ratio of nontannin to tannin. Although the ratio of nontannins to tannins may determine to a certain extent the rate of diffusion of a given vegetable tan in gelatin jelly, it would seem that the more important consideration in penetration is the pH of both the tanning liquor and of the jelly.

TABLE 21.—*Comparison of orders of increasing rate of diffusion and of increasing nontannin to tanin + nontannin ratio.*

Order as observed in Table 20.	Tanning extract.	$\frac{\text{Nontannin}}{\text{Tannin}+\text{nontannin}}$.	Order according to increasing $\frac{\text{Nontannin}}{\text{Tannin}+\text{nontannin}}$ ratio.
1	Philippine black wattle	0.210	3
2	Kamachile	0.374	13
3	Cutch	0.310	9
4	Anabiong	0.525	15
5	Imported black wattle	0.230	4
6	Bitaog	0.236	5
7	Quebracho	0.200	2
8	Valonia	0.330	11
9	Kalumpit	0.176	1
10	Hemlock	0.290	7
11	Bunot	0.330	10
12	Kariskis	0.282	6
13	Betel nut	0.330	10
14	Red oak	0.430	14
15	Myrobalan	0.370	12
16	Chestnut	0.308	8
17	Tanolin		

SUMMARY

The tanning process consists essentially in treating the hide or skin with something that will penetrate or diffuse into the hide, and later fix or combine chemically with the hide substance (collagen).

Collagen is the principal constituent of hides. In physical properties it resembles gelatin which some consider to be the anhydride of collagen.

Experiments with Philippine and foreign tanning materials were made to determine their comparative diffusion in gelatin jelly.

The Philippine materials consisted of extracts made from the barks of anabiong, bitaog, kalumpit, and kariskis; extracts of bunot, kamachile, bakauan, betel nut, and black wattle were also used.

The foreign materials were extracts of quebracho, black wattle, myrobalan, valonia, hemlock, oak, and chestnut. Tanolin was the only chrome tan used.

Generally the vegetable tanning materials diffused faster with an increasing pH value. Tanolin (chrome tan) diffused faster with a decreasing pH value.

Considering the rapidity of the diffusion of tanning materials in gelatin jelly the native black wattle, kamachile, bakauan, and bitaog diffused comparatively slowly. Their diffusion characteristics resemble those of quebracho and they should be good for tanning light leathers where weight and plumpness are not considered.

Kalumpit, like hemlock, diffuses somewhat faster than the materials mentioned above. It may be employed for tanning all kinds of leather, light and heavy.

Extracts of bunot, kariskis, and betel nut should be suitable for preliminary or initial tannage as their diffusion rates are greater than those of kalumpit or hemlock.

In general, the term 'astringency' implies the combining power of a tanning liquor with the hide subtance. Extracts that diffuse comparatively slowly have a relatively high astringency. Considering the order of increasing diffusion as an index of decreasing astringency, the extracts that are slowest to diffuse, such as those of native black wattle, kamachile, bakauan, and bitaog may be considered the most astringent; kalumpit is intermediate as regards diffusion or astringency; and bunot, kariskis, and betel nut are the least astringent (fastest to diffuse) of the Philippine vegetable tanning materials studied.

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ILLUSTRATIONS

TEXT FIGURES

[Drawings prepared by Francisco Rafael.]

FIG. 1. Penetration of bunot, imported black-wattle, betel-nut, bakauan (cutch), and Philippine black-wattle tanning extracts in 7 days with increasing pH.
2. Penetration of myrobalan, chestnut, quebracho, and kamachile tanning extracts in 7 days with increasing pH.
3. Penetration of oak, hemlock, valonia, and anabiong tanning extracts in 7 days with increasing pH.
4. Penetration of tanolin, kalumpit, kariskis, and bitaog tanning extracts in 7 days with increasing pH.
5. Penetration of betel-nut, bunot, imported black-wattle, bakauan (cutch), and Philippine black-wattle tanning extracts in 16 days with increasing pH.
6. Penetration of myrobalan, chestnut, quebracho, and kamachile tanning extracts in 16 days with increasing pH.
7. Penetration of valonia, hemlock, oak, and anabiong tanning extracts in 16 days with increasing pH.
8. Penetration of tanolin, kariskis, kalumpit, and bitaog tanning extracts in 16 days with increasing pH.
9. Penetration of betel-nut, bunot, imported black-wattle, bakauan (cutch), and Philippine black-wattle tanning extracts in 48 days with increasing pH.
10. Penetration of myrobalan, chestnut, quebracho, and kamachile tanning extracts in 48 days with increasing pH.
11. Penetration of oak, hemlock, valonia, and anabiong tanning extracts in 48 days with increasing pH.
12. Penetration of tanolin, kariskis, kalumpit, and bitaog tanning extracts in 48 days with increasing pH.

THE GENUS CYMBIDIUM IN THE PHILIPPINES

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EIGHT PLATES

The genus *Cymbidium* is small so far as the Philippine flora is concerned. Prior to 1932 only two species, *C. atropurpureum* and *C. Finlaysonianum*, were recognized as occurring in the Philippines. Both are epiphytic and characterized by having very long inflorescences. Ames and Quisumbing [1] added to our flora another species, *C. pubescens*, also epiphytic, but with a short inflorescence. The first discovery of an erect, terrestrial *Cymbidium*, *C. Dayanum*, was reported by Ames and Quisumbing [2] in 1933.

In the present paper 6 Philippine species are recognized, 2 of which are new to science.

Key to the Philippine species of Cymbidium.

1. Plant robust, epiphytic; leaves 2 to 5 cm wide.
   2. Inflorescence very long, 60 to 120 cm long, pendulous; lip glabrous.
      3. Leaves narrow, 2 to 2.5 cm wide; flowers dark purple. 1. *C. atropurpureum.*
      3. Leaves broad, 3 to 5 cm wide; flowers greenish yellow. 2. *C. Finlaysonianum.*
   2. Inflorescence short, 15 to 25 cm long, decurved; lip pubescent. 3. *C. pubescens.*
1. Plant slender, terrestrial, cæspitose; leaves 1.1 to 1.6 cm wide.
   2. Petals and sepals greenish.
      3. Sepals oblong or oblong-oblanceolate, obtuse..... 4. *C. Gonzalesii.*
      3. Sepals narrowly linear, acute..... 5. *C. Aliciæ.*
   2. Petals and sepals white with crimson stripe at center..6. *C. Dayanum.*

Genus CYMBIDIUM Swartz

1. CYMBIDIUM ATROPURPUREUM (Lindl.) Rolfe. Plate 1, figs. 1 and 2; Plate 4.

Cymbidium atropurpureum (Lindl.) ROLFE, Orch. Rev. 11 (1903) 190; AMES, Orch. 2 (1908) 218; ibid. 5 (1915) 199; in Merr. Enum. Philip. Fl. Pl. 1 (1925) 403.

[1] Philip. Journ. Sci. 49 (1932) 491.
[2] Ibid. 52 (1933) 450.

Cymbidium pendulum Sw. var. *atropurpureum* LINDL., Gard. Chron. (1854) 287; HOOK. f., Bot. Mag. 94 (1868) *t. 5710.*

? Cymbidium pendulum VIDAL, Phan. Cuming. Philip. (1885) 150 pp.; Rev. Pl. Vasc. Filip. (1886) 269 pp., *non* Sw.

Cymbidium Finlaysonianum Lindl. var. *atropurpureum* VEITCH, Man. Orch. Pl. pt. 9 (1893) 16.

Cymbidium pendulum Sw. var. *purpureum* W. WATS., Orchids ed. 2 (1895) 151, sphalm.

This species was originally described as a var. *atropurpureum* by Lindley. In 1903 Rolfe elevated the var. *atropurpureum* into specific rank. On the basis of Philippine materials examined, particularly living ones, there can be no doubt as to the specific distinction of *Cymbidium atropurpureum* from the common *Cymbidium Finlaysonianum.*

The original description reads as follows:

Var. *atro-purpurea;* sepals petalisque extus flavo-viridibus intus atropurpureis, labelli pallide purpureo-maculati lobo intermedio lateralibus triplo majore recurvo basi dilatato.

Habit of *C. Finlaysonianum.* Stems tufted, stout. Leaves ensiform, 60 to 90 cm long, 2 to 2.5 cm wide, deeply grooved, sheathing and expanded at base, keeled, very leathery, obliquely obtuse. Racemes long, 40 cm to 75 cm, pendulous. Flowers numerous, laxly arranged, 3 to 3.5 cm across. Sheaths membranaceous, up to 7.5 cm long. Bracts minute. Petals and sepals similar in shape and color except petals slightly wider, linear-oblong, narrowed to the obtuse apex, velvety, fleshy, Bordeaux (dark purple), tips of lateral sepals flushed with dull greenish yellow, 2.4 to 2.5 cm long, 5 to 6 mm wide. Labellum recurved, shorter than sepals; lateral lobes small, apex subacute, pale purple (pomegranate purple) 2 to 2.5 mm long; middle lobe broadly oblong-cordate, obtuse, emarginate, sharply decurved, white, tip tinged with rose and with a few purple spots and at the notch bright reddish purple, disc primuline yellow, with two continuous, parallel lamellæ which are divergent at the base. Column Bordeaux, erect, 1.5 cm long. Anther broad, amber yellow. Pollinia ovoid.

LUZON, Benguet Subprovince, Baguio, Mount Mirador, *For. Bur. 20237 Sandkuhl:* Rizal Province, Montalban, *Bur. Sci. 5645 Schultze:* Manila, cultivated, *Phil. Nat. Herb. 462 Quisumbing.* LEYTE, *Wenzel 103.* MINDANAO, Surigao Province, Lake Mainit, *Bur. Sci. 84157 Ramos and Convocar:* Davao Province, Malita, *Copeland 648.* It is doubtful that the Baguio and Rizal specimens listed above are natives of those

places; they were probably introduced into those localities as ornamentals.

2. CYMBIDIUM FINLAYSONIANUM Lindl. Plate 1, figs. 5 and 6; Plate 3.

Cymbidium Finlaysonianum LINDL. in Wall. Cat. (1832) No. 7358, *nomen;* Gen. & Sp. Orch. Pl. (1833) 164; HOOK. f., Fl. Brit. Ind. 6 (1890) 11; VEITCH, Man. Orch. Pl. pt. 9 (1893) 16; RENDLE, Journ. Bot. 39 (1901) 175; J. J. SM., Fl. Buitenz. 6 (Orch. Jav.) (1905) 481; Fig.-Atlas (1911) *fig. 366;* RIDL., Mat. Fl. Mal. Penin. 1 (1907) 139; AMES, Orch. 2 (1908) 218; ibid. 5 (1915) 199; in Merr., Journ. Roy. Asiat. Soc. Straits Branch Special No. (1921) 192; in Merr., Enum. Philip. Fl. Pl. 1 (1925) 403; SCHLTR. in Fedde Repert. 10 (1911) 190; Die Orchideen (1914) 358.

Cymbidium pendulum BLUME, Bijdr. (1825) 379; MIQ., Fl. Ind. Bat. 3 (1859) 707; LINDL., Bot. Reg. 26 (1840) *t. 25* (excl. syn.); REICHB. f. in Walp., Ann. 6 (1863) 624, *quoad spec.;* NAVES, Novis. App. (1882) 245; VIDAL, Phan. Cuming. Philip. (1885) 150 pp.; Rev. Pl. Vasc. Filip. (1886) 269 pp.; WARNER & WILL., Orch. Alb. 10 (1893) *t. 437* (excl. syn. in part), *non* Sw.

Cymbidium aloifolium LINDL. in Wall., Cat. (1832) No. 7352, A & B; NAVES, Novis. App. (1882) 245; RIDL. in Trans. Linn. Soc. II 3 (1893) 368; Journ. Linn. Soc. 32 (1896) 333; AMES, Orch. 1 (1905) 101; MERR., Philip. Journ. Sci. 1 (1906) Suppl. 39, *non* Sw.

Cymbidium Wallichii LINDL., Gen. & Sp. Orch. Pl. (1833) 165; MIQ., Fl. Ind. Bat. 3 (1859) 707; NAVES, Novis. App. (1882) 245.

Cymbidium pendulum Sw. var. *brevilabre* LINDL., Bot. Reg. 28 (1842) misc. 60; ibid. 30 (1844) *t. 24;* PAXT., Mag. Bot. 11 (1844) 115; REICH. f. in Walp., Ann. 6 (1863) 624.

Cymbidium tricolor MIQ., Choix des Pl. (1864) *t. 19.*

Epiphytic. Stems short, stout. Leaves ensiform, thick, leathery, 60 to 100 cm long, 3.5 to 5 cm wide, strongly furrowed, obtuse and retuse. Racemes very long, 60 to 140 cm, pendulous. Flowers numerous, loosely arranged, 3.5 to 4 cm across. Petals and sepals subequal. Sepals linear-oblong, 2.6 to 3.5 cm long, 0.8 to 1 mm wide. Petals oblong-elliptic, obtuse, 2.5 to 3 cm long, 0.7 to 0.9 mm wide. Labellum 3-lobed, not saccate; lateral lobes acute, 6 to 8 mm long, rose, streaked with rosolane-purple; middle lobe recurved, suborbicular, 12 to 14 mm long, 10 to 13 mm wide, white, rosolane-purple at notch, barium-yellow at base; the two parallel lamellæ amber-yellow, extending from base of midlobe to base of lip. Column slightly curved, reddish, 1.7 to 1.9 cm long. Another suborbicular, amber-yellow. Fruit obovoid, or oblong-obovoid, 4 to 10 cm long, 3 to 4 cm in diameter.

Throughout the Philippines, from sea level up to 250 meters altitude. Represented by numerous collections from many

provinces in Luzon, Polillo, Bohol, Palawan, Dinagat, Tawi-Tawi, and Mindanao. In Burma, Malay Peninsula, Java, Celebes, Borneo, Sumatra, and Indo-China.

Differs from *C. atropurpureum* in its much longer and wider leaves, larger flowers of dull yellowish green tinted with olive, and in the acute side lobes of the lip.

3. CYMBIDIUM PUBESCENS Lindl. Plate 1, figs. 3 and 4; Plate 5.

Cymbidium pubescens LINDL., Bot. Reg. 26 (1840) misc. 75; ibid. 27 (1841) *t. 38;* HOOK, f., Fl. Brit. Ind. 6 (1890) 11; J. J. SM., Fl. Buitenzorg. Orch. Java 6 (1905) 483; Fig.-Atlas (1911) *fig. 368;* SCHLECHTER, Die Orchideen (1927) 362; AMES & QUIS., Philip. Journ. Sci. 49 (1932) 491, *t. 2, figs. 4, 5; t. 8, 21, 22.*

Cymbidium aloifolium BLUME, Bijdr. (1825) 378.

Cymbidium bicolor LINDL., (p. p.) Gen. & Sp. Orch. pl. (1833) 164; MIQ., Fl. Ind. Bat. 3 (1859) 707; REICH. f. in Walp., Ann. 6 (1863) 625.

The original description reads as follows:

C. pubescens; foliis ensiformibus striatis apice oblique bidentatis, racemo brevi pendulo, bracteis minimis squamaeformibus, sepalis petalisque linearibus acutiusculis, labelli trilobi basi saccati intus pubescentis laciniis lateralibus acutis intermedia oblonga subundulata obtusa, lamellis rectiusculis medio interruptis.

An epiphyte with much the habit of *Cymbidium atropurpureum* (Lindl.) Rolfe. Leaves clustered, coriaceous, sessile, dark green, ligulate-linear, 50 to 53 cm long, 1.75 to 1.9 cm wide, striated, notch at apex very oblique. Racemes pendulous, 5 to 10-flowered, 15 to 25 cm long; peduncles glabrous, about 11.5 cm long, 4 mm in diameter, clothed at base with 3 tubular sheaths; sheaths light green, basal sheaths shortest, oblong when expanded, acute, about 3 cm long, 2 cm wide, two upper sheaths linear-lanceolate, acute, 4 to 4.5 cm long, about 1.5 cm wide. Floral bracts minute, squamiform, triangular, acute, 2.5 to 3 mm long. Pedicellate ovary 1.3 to 1.5 cm long. Flowers odorless, about 3 cm across. Lateral sepals spreading, narrowly oblong or slightly oblanceolate, acute, slightly oblique, 1.5 to 1.7 cm long, 5 to 5.5 mm wide, 7-nerved. Dorsal sepal similar, erect. Petals spreading, lanceolate or elliptic-lanceolate, acute, 1.4 to 1.55 cm long, 4.75 to 5 mm wide, 5-nerved. Labellum trilobed, suborbicular-ovate in outline when expanded, saccate at base, minutely pubescent on both surfaces, more so within and on margins; lateral lobes semiovate with free apices, short, triangular, porrect, acute, 3 to 3.5 mm long; middle lobe broadly oblong to suborbicular, 7 to 7.5 mm long, 5.5 to 6.25 mm wide, apex rounded, recurved,

apiculate at the very tip; disc with a pair of subparallel fleshy lamellæ or ridges at base in front of which stands another pair of smaller calli. Column long, arcuate, footless, slightly thickened at apex, 10 to 11.5 mm long. Anther semiglobose. Pollinia 2, complanate-pyriform.

LUZON, Manila, Bureau of Science orchid house, *Bur. Sci. 84547 Quisumbing*, January 13, 1931. The living plants, which are now in cultivation in Manila, were collected near Butuan, Agusan Province, Mindanao, where they grow on trees at low altitudes. The sepals and petals etruscan-red or acajou-red, broadly edged with deep colonial buff; lateral lobes of labellum ivory-yellow dotted with ox-blood-red. Column pompeian-red; anther light orange-yellow above and amber-brown below.

Lindley [3] states—"Although the woods of Singapore have been so often examined by botanists it seems as if the forms of vegetation there were inexhaustible. The species now figured was met with by Mr. Cuming who sent it to Messrs. Loddiges." This species, which is distributed over the Malay Peninsula, Sumatra, Java, Banca, and Siam, *fide* Ridley, doubtless belongs in the group with *C. Finlaysonianum* Lindl. and *C. atropurpureum* (Lindl.) Rolfe. It has the general habit of *C. atropurpureum* and resembles it in the form and size of leaves, but is distinct from both species in having very much shorter racemes, smaller flowers, and a pubescent labellum, as well as in the color of the flowers. *Cymbidium pubescens* Lindl. is reported here for the first time from the Philippines, although several sterile and fruiting specimens in the herbarium of Oakes Ames perhaps represent it. The plant thrives best in orchid pots which contain crushed tuff as a substratum or in wooden baskets. The cymbidiums of the Philippines are among the hardiest of orchids. They even grow luxuriantly perched up on branches of trees.

4. CYMBIDIUM GONZALESII Quis. sp. nov. Plate 2, figs. 1 and 2; Plate 6.

Pseudobulbis aggregatis, foliis erectis, 3 ad 4, anguste linearibus, 20 ad 42 cm longis, 1.4 ad 1.6 cm latis. Scapus erectus, ca. 24 cm longus. Sepalis lateralibus oblique oblongo-oblanceolatis, apice obtusis, 2.2 ad 2.8 cm longis, 0.7 ad 0.9 cm latis. Sepalum dorsale oblongum vel oblongo-oblanceolatum, apice obtusum, 2.3 ad 3 cm longum, 0.8 ad 1 cm latum. Petala linearioblonga, apice obtusa 2 ad 2.5 cm longa, 0.7 ad 0.8 cm lata. La-

[3] Bot. Reg. 27 (1841) *t. 38.*

bellum 3-lobatum, subunguiculatum, lobis lateralibus erectis, subrotundatis, brevibus, ca. 2.5 mm longis; intermedio triangulari-ovato, apice obtuso 0.9 ad 1 cm longo, 0.8 ad 0.9 cm lato, basi callis duobus. Columna elongata, subcomplanata, 1.4 ad 1.6 cm longa.

Terrestrial, grasslike in habit, erect. Pseudobulbs of old plants ovoid, approximate, prominent after the leaves die and drop off. Leaves erect, somewhat leathery, dark green, narrowly linear, acute, 20 to 42 cm long, 1.4 to 1.6 cm wide, 5-nerved. Scape erect, few-flowered, about 24 cm tall. Flowers odorless, with spreading sepals, petals spreading after anthesis, 3.5 to 4 cm across. Lateral sepals obliquely oblong-oblanceolate, obtuse, 2.2 to 2.8 cm long, 0.7 to 0.9 cm wide. Dorsal sepal oblong or oblong-oblanceolate, obtuse, 2.3 to 3 cm long, 0.8 to 1 cm wide. Petals linear-oblong, obtuse, 2 to 2.5 cm long, 0.7 to 0.8 cm wide. Labellum 3-lobed, subunguiculate; lateral lobes erect, subrounded, short, about 2.5 mm long; middle lobe triangular-ovate, obtuse, 0.9 to 1 cm long, 0.8 to 0.9 cm wide; two prominent lamellæ extending from base of middle lobe to base of labellum. Column elongated, somewhat flattened, 1.4 to 1.6 cm long. Anther cap subquadrate.

LUZON, Manila, Gonzáles's garden, *Phil. Nat. Herb. 5782 E. Quisumbing,* July 18, 1938. The living plants were collected from the open grasslands in Rizal Province, at medium altitudes. Petals and sepals light viridine-green, flushed at the tips with viridine-yellow and lined with maroon. Labellum almost white, washed with very faint yellow, lobes barred or spotted with pomegranate-purple, throat citron-yellow, calli empire-yellow. Column citron-yellow.

C. Gonzalesii is somewhat allied to *C. Faberi* Rolfe of China. In general appearance the flowers resemble those of *C. Finlaysonianum,* differing in color and details of the floral parts. Its striking difference lies in its grasslike habit, narrow leaves and erect scapes. This species is dedicated to Mr. José S. Gonzáles, a lover and grower of orchids.

5. CYMBIDIUM ALICIAE Quis. sp. nov. Plate 2, figs. 5 and 6; Plate 7.

Planta parva et gracilis. Folia angusta, lineari-lorata, subcoriacea, 45 ad 60 cm longa; 1.2 ad 1.4 cm lata. Scapus erectus, pauciflorus, 19 ad 20 cm longus. Sepala lateralia angustissime lineari-lanceolata, apice acuminata; 2.5 ad 2.7 cm longa, 3.5 ad 4 mm lata. Sepalum dorsale erectum, anguste lineari-lanceolatum, apice acuminatum, 2.8 ad 3 cm longum, 3 ad

4 mm latum. Petala angustissime lineari-lanceolata, apice acuminata, 2.3 ad 2.5 cm longa, 4.5 ad 5 mm lata. Labellum trilobatum, circiter 20 mm longum; lobi laterales erecti, lati, apiculati, circiter 4 mm longi; lobus medius in positu naturali reflexus expansus triangulari-oblongus, 7 ad 8 mm longus, 5 ad 5.5 mm latus. Columna curvata, subcomplanata, 10 ad 11 mm longa.

Plant terrestrial, erect, acaulescent. Leaves 8 or 10, tufted, subcoriaceous, pale green, curved, elongate, linear, channelled at the base, tapering to the acute apex, 45 to 60 cm long, 1.2 to 1.4 wide. Racemes erect, few-flowered, 19 to 20 cm long; sheaths three, imbricated, 2.4 to 3 cm long, greenish. Pedicillate ovary about 2.5 cm long, greenish purple. Flowers slightly fragrant, 4.5 to 5 cm long, 3 to 3.5 cm across; bracts greenish, subulate, 8 mm long. Lateral sepals spreading, slightly falcate, tips bent backward, narrowly linear-lanceolate, acuminate, 2.5 to 2.7 cm long, 3.5 to 4 mm wide at widest part. Dorsal sepal erect, narrowly linear-lanceolate, apex acuminate, 2.8 to 3 cm long, 3 to 4 mm wide. Petals shorter than sepals, narrowly linear-lanceolate, apex acuminate, 2.3 to 2.5 cm long, 4.5 to 5 mm wide. Labellum 3-lobed; lateral lobes short, broad, apiculate, free portion 4 mm long; middle lobe triangular-oblong, acute, reflexed, 7 to 8 mm long, 5 to 5.5 mm wide; lamellæ two, stout at middle, parallel, glabrous, ending abruptly with the lateral lobes, discontinuous with middle lobe. Column curved, somewhat flattened, 10 to 11 mm long. Anther broadly triangular-ovoid, about 2 mm long.

LUZON, Rizal Province, Baclaran, Mrs. Kenneth B. Day's Garden, *Philip. Nat. Herb. 400 E. Quisumbing,* September 18, 1934. Living plants were collected from the mountains of Nueva Vizcaya Province.

The sepals and petals naphthalene-yellow except the tips of sepals which have a very slight tinge of purple. Lateral lobes of labellum rosolane purple; middle lobe white, with a few blotches of pale rosolane-purple; lamellæ chalcedony-yellow. Column and anther pale dull green-yellow.

C. Aliciae is closely allied to *C. cyperifolium* Wall., differing in the details of the flower parts particularly the labellum. In habit it is similar to *C. Aliciae.* It differs in its flowers, particularly the narrowly linear-lanceolate petals and sepals, and in the details of the shape and structure of the labellum. The species is named in honor of Mrs. Kenneth B. Day.

6. CYMBIDIUM DAYANUM Reich. f. Plate 2, figs. 3 and 4; Plate 8.

Cymbidium Dayanum REICHB. f., Gard. Chron. (1869) 710; Williams' Orch. Grow. Man. ed. 7 (1894) 218; RIDL., Fl. Mal. Penin. 4 (1924) 146; Sanders' Orch. Guide (1927) 138; AMES & QUIS., Philip. Journ. Sci. 52 (1933) 450, *t. 1, figs. 7, 8; t. 4, fig. 1; t. 5, figs. 16, 17.*

Cymbidium acutum RIDL., Journ. Linn. Soc. 32 (1896) 334; Mat. Fl. Mal. Penin. 1 (1907) 140; SCHLTR., Die Orchideen (1927) 355.

Cymbidium Simonsianum KING and PANTL., Journ. As. Soc. Beng. pt. 2 64 (1895) 338; Ann. Roy. Bot. Gard. Calc. Orch. Sik.-Himal. 8 (1898) 188, *t. 250.*

The original description reads as follows:

Cymbidium Dayanum, sp. n.

Foliis longissimis (4 pedalibus), angustis (vix quartam pollicis latis) coriaceo-pergameneis apice nunc inaequali altero latere acutis, nunc aequaliter, bidentatis, inferne suberosis; racemo plurifloro; vaginis scariosis acutis basi vaginato; rhachi angulata, bracteis triangulis acuminatis ovariis pedicellatis multo brevioribus, mento subevanido; flore carnosiusculo; sepalis linearibus acuminatis; petalis sublatioribus brevioribus, labello medio trifido, lacinis lateralibus semiovatis, acutangulis, lacinia media oblongo-triangula acuminata; carinis geminis parallelis approximatis velutinis, usque ad basin laciniarum lateralium altioribus, dein humilibus, ante apicem confluentibus.

Plant terrestrial, grasslike, erect, stemless. Leaves 5 or 6, tufted, subcoriaceous, pale green, elongate-linear, sessile, channelled at base, acute and suboblique at apex, 76.5 to 78.5 cm long, 1.1 to 1.4 cm wide. Racemes erect, about 24 cm long; peduncle about 11 cm long; sheaths at base three or more, imbricated, 1 to 7 cm long, acute, pinkish vinaceous, lowermost sheath nearly white. Pedicellate ovary 1.5 to 3 cm long. Flowers fragrant, about 10, 3.5 to 4.5 cm across; bracts triangular, acute, cucullate, 5 to 8 mm long. Lateral sepals spreading, elliptic-lanceolate or oblanceolate, acute and subfalcate, 2.6 to 2.7 cm long, 7 to 8 mm wide. Dorsal sepal erect, elliptic-lanceolate or oblanceolate, acute, 2.8 to 2.9 cm long, 7 to 7.5 mm wide. Petals smaller than sepals, connivent around column, narrowly elliptic-oblong, acute, apiculate, 2.1 to 2.2 cm long, about 6 mm wide. Labellum 3-lobed, 2 to 2.2 cm long; lateral lobes broadly obtuse, free portion 3 to 3.5 mm long; middle lobe ovate, apiculate, reflexed, 7 to 7.5 mm wide; lamellæ two, stout, parallel, conspicuously pubescent with white glandular hairs, ending abruptly opposite apices of lateral lobes, but continued to middle lobe as raised lines. Column about 12 mm long. Anther broadly triangular ovoid. Pollinia obliquely ovoid, compressed.

LUZON, Baguio, Mrs. Kenneth B. Day's Garden, *Bur. Sci. 85569 E. Quisumbing,* October 20, 1931. Living plants originally collected by Mrs. Kenneth B. Day in Baguio, Benguet Subprovince.

The flower are fragrant, the sepals and petals are white with a crimson central line which does not extend to their apices, the labellum is Bordeaux with oblique white and seafoam-yellow lines on the lateral lobes. The column is blackish red-purple, the anther sulphur-yellow. Pedicellate ovary lumiere-green.

Sikkim, Assam, and Perak (Waterloo) at altitudes from 800 to 1,200 meters.

From the other five species of *Cymbidium* known to occur in the Philippines, *Cymbidium Dayanum* is distinguished by its grasslike, tufted leaves and by the color of the flowers.

In habit *Cymbidium Dayanum* is similar to *Cymbidium Gonzalesii* and *Cymbidium Aliciae,* differing, however, in the color of the flower and in the details of the lip and particularly in the conspicuously pubescent lamellæ.

ILLUSTRATIONS

Plate 1

Fig. 1. *Cymbidium atropurpureum* (Lindl.) Rolfe; front view of flower, × 1.
2. *Cymbidium atropurpureum* (Lindl.) Rolfe; side view of flower, × 1.
3. *Cymbidium pubescens* Lindl.; front view of flower, × 1.
4. *Cymbidium pubescens* Lindl.; side view of flower, × 1.
5. *Cymbidium Finlaysonianum* Lindl.; front view of flower, × 1.
6. *Cymbidium Finlaysonianum* Lindl.; side view of flower, × 1.

Plate 2

Fig. 1. *Cymbidium Gonzalesii* Quis. sp. nov.; front view of flower, × 1.
2. *Cymbidium Gonzalesii* Quis. sp. nov.; side view of flower, × 1.
3. *Cymbidium Dayanum* Reichb. f.; front view of flower, × 1.
4. *Cymbidium Dayanum* Reichb. f.; side view of flower, × 1.
5. *Cymbidium Aliciae* Quis. sp. nov.; front view of flower, × 1.
6. *Cymbidium Aliciae* Quis. sp. nov.; side view of flower, × 1.

Plate 3. Cymbidium Finlaysonianum Lindl.

Fig. *1*, habit of plant in flower, very much reduced; *2*, front view of flower, × 0.66 (*circa*); *3*, side view of flower, × 0.66 (*circa*); *4*, labellum, stretched out, viewed from above, × 0.66 (*circa*); *5*, front view of column (natural position), × 1.33 (*circa*); *6*, dorsal sepal, × 0.66 (*circa*); *7*, petal, × 0.66 (*circa*); *8*, lateral sepal, × 0.66 (*circa*); *9*, anther, viewed from above, × 4 (*circa*); *10*, anther, viewed from below, × 4 (*circa*); *11*, pollinia, × 4 (circa).

Plate 4. Cymbidium atropurpureum (Lindl.) Rolfe

Fig. *1*, dorsal sepal, × 1; *2*, petal, × 1; *3*, lateral sepal, × 1; *4*, front view of column and labellum (natural position), × 1.5; *5*, side view of column and labellum, × 1.5; *6*, labellum, stretched out, viewed from above, × 1.5; *7*, anther, viewed from above, × 8; *8*, anther, viewed from below, × 8; *9* and *10*, pollinia, × 8.

Plate 5. Cymbidium pubescens Lindl.

Fig. *1*, dorsal sepal, × 1; *2*, petal, × 1; *3*, lateral sepal, × 1; *4*, front view of column and labellum (natural position), × 1.5; *5*, side view of column and labellum (natural position), × 1.5; *6*, labellum, stretched out, viewed from above, × 1.5; *7*, anther, viewed

from above, × 8; *8*, anther, viewed from below, × 8; *9* and *10*, pollinia, × 8.

PLATE 6. CYMBIDIUM GONZALESII QUIS. SP. NOV.

FIG. *1*, habit of a flowering plant, × 0.33 (*circa*); *2*, bract, × 3; *3*, dorsal sepal, × 1; *4*, petal, × 1; *5*, lateral sepal, × 1; *6*, side view of flower, × 0.66 (*circa*); *7*, front view of flower, × 0.66 (*circa*); *8*, side view of column and labellum (natural position), × 1; *9*, front view of column and labellum (natural position), × 1; *10*, labellum, stretched out, viewed from above, × 1; *11*, front view of column, × 2; *12*, side view of column, × 2; *13*, anther, viewed from above, × 7; *14*, anther, viewed from below, × 7; *15*, pollinia, × 7.

PLATE 7. CYMBIDIUM ALICIAE QUIS. SP. NOV.

FIG. *1*, habit of a flowering plant, × 0.6 (*circa*); *2*, front view of flower, × 1; *3*, side view of flower, × 1; *4*, dorsal sepal, × 1; *5*, petal sepal, × 1; *6*, lateral sepal, stretched out, × 1; *7*, lateral sepal (natural position), × 1; *8*, front view of column and labellum (natural position), × 1.5; *9*, side view of column and labellum (natural position), × 1.5; *10*, labellum, stretched out, viewed from above, × 1.5.

PLATE 8. CYMBIDIUM DAYANUM REICHB. F.

FIG. *1*, dorsal sepal, × 1; *2*, petal, × 1; *3*, lateral sepal, × 1; *4*, side view of flower, × 1; *5*, front view of flower, × 1; *6*, side view of column and labellum (natural position), × 1; *7*, front view of column and labellum (natural position), × 1; *8*, stretched out labellum, viewed from above, × 1; *9*, another, viewed from above; × 8; *10*, anther, viewed from below, × 8; *11* and *12*, pollinia, × 8.

PLATE 1.

PLATE 2.

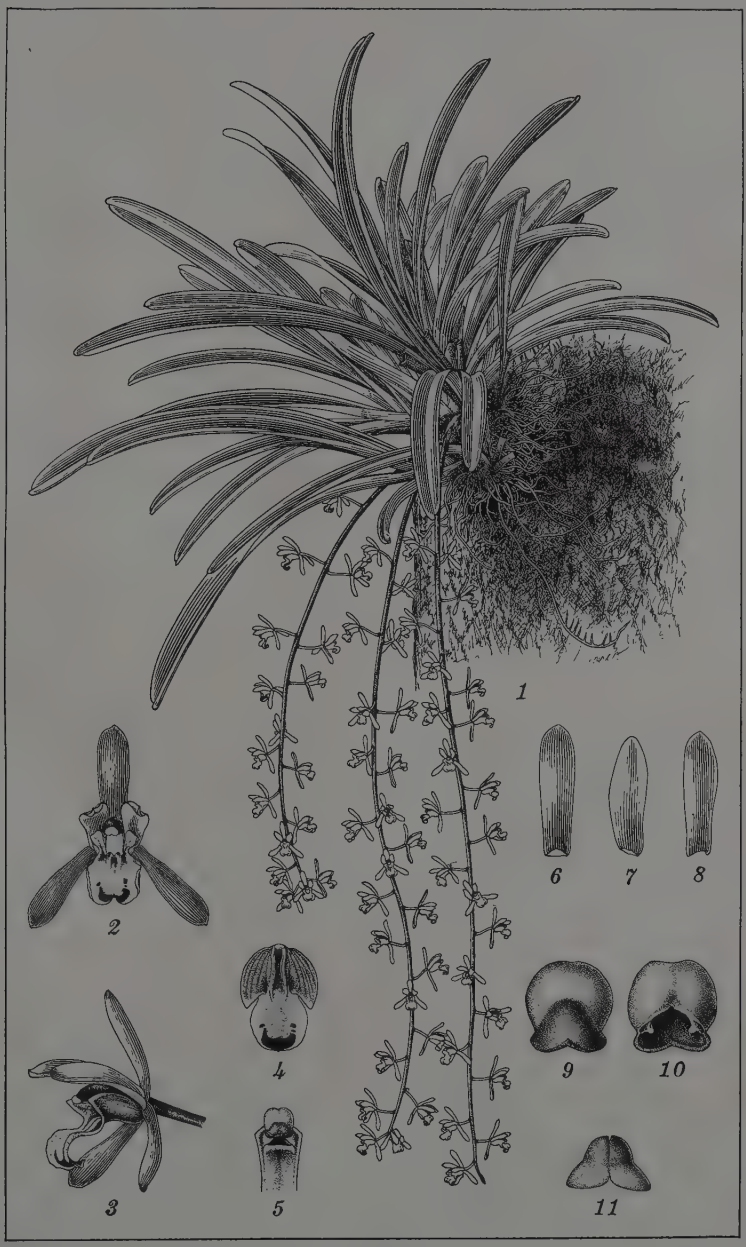


PLATE 3.

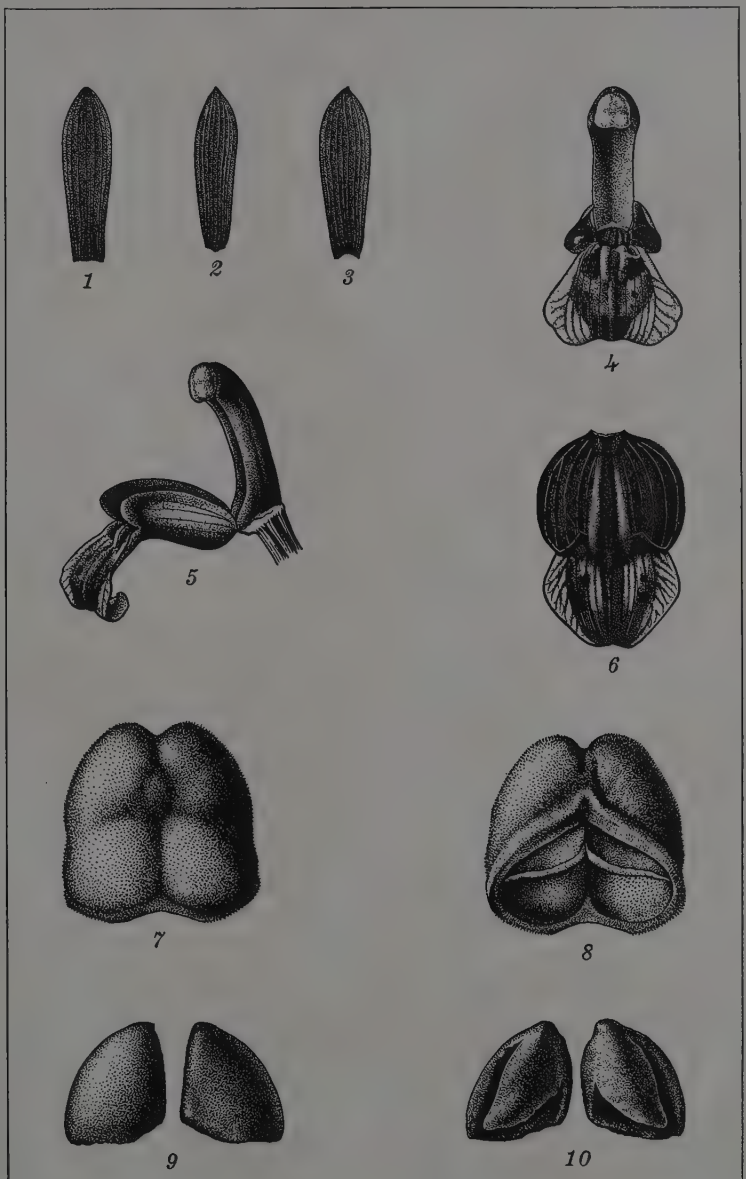


PLATE 4.

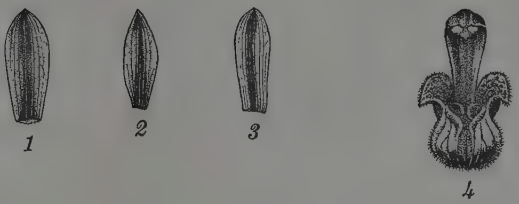


PLATE 5.

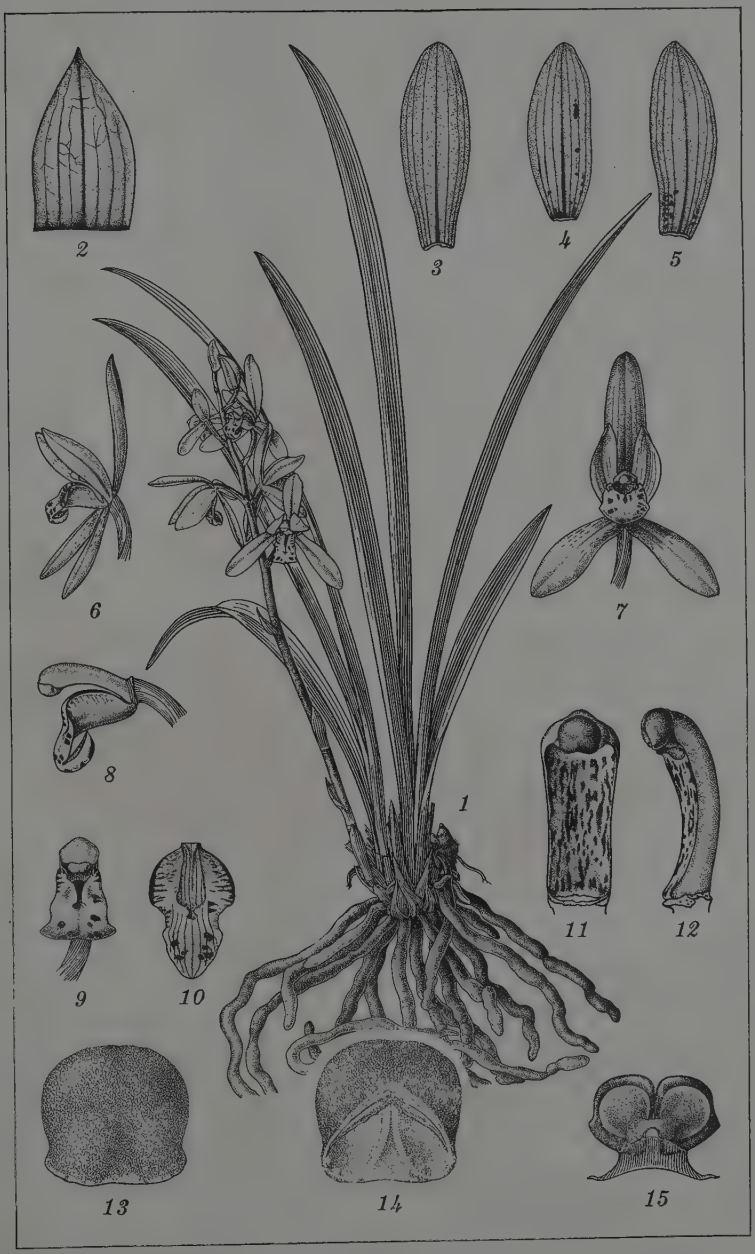
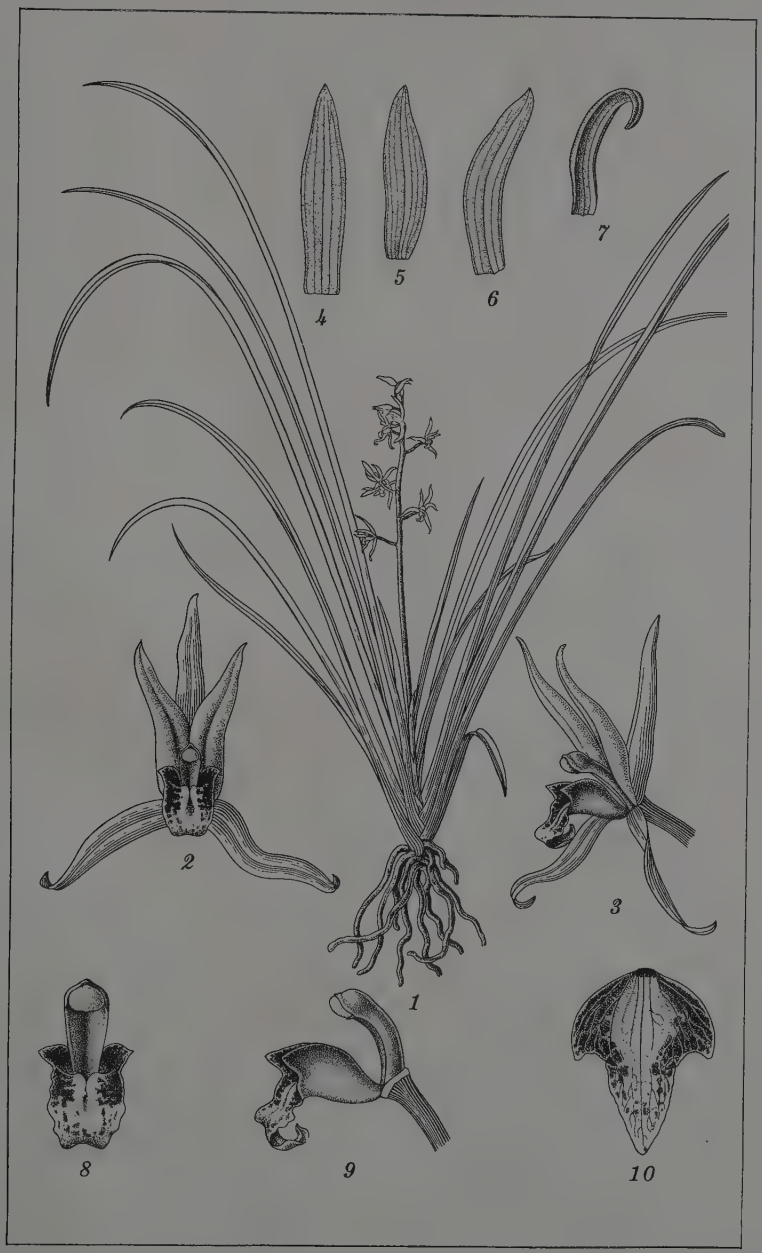


PLATE 6.



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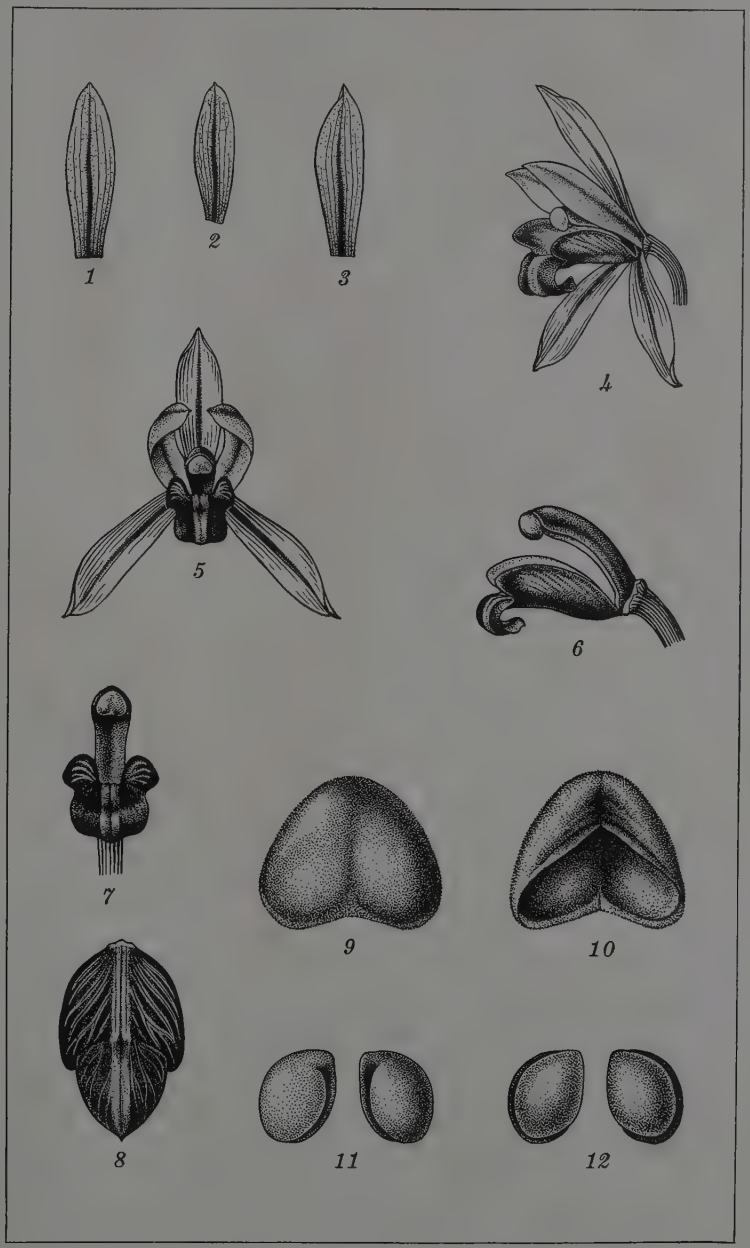

PLATE 8.

BOOKS

Books reviewed here have been selected from books received by the Philippine Journal of Science from time to time and acknowledged in this section.

REVIEWS

The Story of Vitamin B_1. Compiled by C. R. Addinall. Rahway, N. J., Merck & Co., Inc. 1937. 55pp., illus.

This brochure briefly discusses an important dietary element, vitamin B_1. The first part of this book deals with a short historical survey of the different scientific investigations about vitamins which lead finally to the discovery of vitamin B_1. It presents the rapid progress which has been made recently by various scientific researchers on the isolation and identification of this unknown substance, and clearly describes its chemical composition and therapeutic properties. It also illustrates the different biological, chemical, and biochemical processes of assaying vitamin B_1 as it occurs in various materials. It also presents authoritative information regarding the standardization of vitamin B_1 as recommended by the International Conference on Vitamin Standardization. It is of great value to physicians and students of nutrition, for it offers them sufficient data regarding this important substance.

The brochure is illustrated, well indexed, and contains references after each chapter.—P. J. A.

Diseases and Parasites of Poultry. By Edgar Hugh Barger and Leslie Ellsworth Card. 2d ed., thoroughly revised. Philadelphia, Lea & Febiger, 1938. 386 pp., illus. Price, $3.75.

This book is a valuable treatise on the anatomy and surgery of poultry and the pathology of practically all the diseases and parasites with which the avian family is afflicted. The authors divided their subject matter into fourteen well-organized chapters, each covering a specific phase of the problem. The first five chapters are devoted to preliminary but important considerations in the study of poultry diseases and parasites. In this section of the book the authors brings out the importance and extent of poultry mortality, the nature of poultry diseases, the

anatomy and surgery of the fowl, and diagnostic, preventive, and control methods in the study of the different poultry ailments. The next eight chapters are extensive and well-coördinated discussions on each of the numerous diseases, parasites, and nutritional and physical disorders, grouped according to the nature of their causes. Specific diagnostic directions and preventive and control measures are given in each case. A discussion on the control of flock mortality, which raises several problems directed to either the poultryman or the poultry researcher, forms the concluding chapter of the book. To enhance the usefulness of the book the authors have included a list of classified references at the end of each chapter, effective illustrations throughout, a list of periodicals which regularly or occasionally contain articles on poultry diseases and parasites, an authors' index, and a subject index.

The poultryman, the poultry instructor, and the poultry researcher will find this book an ideal reference.—P. G. R.

The Individual Criminal. Studies in the Psychogenetics of Crime. By Ben Karpman. Volume I, Cases 1 to 5. Washington, D. C., Nervous and Mental Disease Publishing Co., 1935. 317 pp., tables. Price, $4.50.

Those interested in the psychogenetics of crime should read this very illuminating book by Doctor Karpman. It is a presentation of case studies made by the author, who is one of America's famous psychotherapists, interested in "our doubly unfortunate friends, the criminal Insane". Doctor Karpman's approach to the study of the individual criminal is essentially psychogenetic. In his foreword, he says:

> We try to understand a social situation through the study of the individual components. We take here the life history of each individual criminal as it presents itself to us, attempting to trace it to its early beginnings, noting the stages of its development, the influences that shaped its progress, points of arrested development, deviations, and retrogressions. We further attempt not only to describe the phenomena presented, but to find reasons for their appearance and existence; that is, we search for the underlying mechanisms and processes.

There is something more in what the author says that arrests our attention:

> In a large sense, we are all born criminals because we are born unconditioned and unrepressed. It is the function of civilization to so train us and direct our tendencies that we are willing to yield a part of ourselves in the service of culture . . . The criminal component which we all seem to have had during the childhood does not disappear entirely from our life as we reach adolescence, but crops out in the numerous irregularities and transgressions of which many of us are often guilty. Many of these

are supposedly within the limits of the normal. The state or government official who in furtherance of his own political ambition appoints to office a friend rather than a stranger who is better qualified, is not only violating the oath of his office, but the better interests of society as well. While there is no law to reach him, I regard him as a criminal nonetheless. The physician who pays unnecessary visits to his patients in order to extract more money from them, not only fails to live up to the best ethics of his profession, but is guilty of behavior essentially criminal in character; as is also the lawyer who deliberately misleads his clients for reasons of personal gain. There are also many other forms of behavior that variously express our criminal tendencies. The coefficient of criminality varies with each one of us and no one knows when his dormant criminality is likely to come to the surface".

The author has so aptly described the genesis of crime, that the reviewer cannot escape the temptation to quote him at length. Those who will find time to go over the pages of this book will be rewarded with a clearer insight into the nature of the individual criminal.—S. G. P.

School for Riding. A Primer of Modern Horsemanship. By Sergei Kournakoff. Boston, Hale, Cushman & Flint, 1938. 180 pp., front. illus., appendix. Price, $2.50.

There are a number of books written on the subject of equitation, and this one by Sergei Kournakoff is most interesting. Its language and style are simple, and there are ample illustrations. The book consists of twelve chapters, each presenting a different phase of riding instructions. As a whole, the book is a very practical aid to those who desire knowledge on practical equitation. It will be useful not only to students but also to those already acquainted with the subject—L. S.

Practical Aspects of Psychoanalysis. A Handbook for Prospective Patients and Their Advisors. By Lawrence S. Kubie. New York, W. W. Norton & Co., Inc., 1936. 223 pp. Price, $2.

This book by Doctor Kubie, written in a very simple style, is a clarification and explanation of the practice of psychoanalysis. Of late there has been a lot of confusion as to the meaning of psychoanalysis, arising from the divergent views of such "psychoanalysts" as Freud, Jung, Adler, Rank, Stekel, and a host of other psychoanalysts. In order to clarify the meaning of psychoanalysis, Doctor Kubie has written this book especially for the layman and physician. Thus Doctor Kubie observes that the term "psychoanalysis" should "be applied only to the method evolved by Freud and to the theories derived from the use of this method. A psychoanalyst is therefore a person who uses Freud's technique, and anyone who does not use this tech-

nique should not be called a psychoanalyst." The book is designed to answer many of the questions that have been asked about the practice of psychoanalysis.

In the Philippines psychoanalysis is as yet unknown, especially to the layman. It is timely therefore that anyone who is interested in the practice of psychoanalysis should read this book.—S. G. P.

Jurisprudence for Nurses. Legal Knowledge Bearing upon Acts and Relationships Involved in the Practice of Nursing. By Carl Scheffel, in Collaboration with Eleanor McGarvah. 2d ed. New York, Lakeside Publishing Co., 1938. 248 pp. Price, $3.

This book on jurisprudence for nurses will be very helpful to the nursing profession, especially in the present era when human relations are becoming more and more complex everyday. Nurses, like the other members of the community, have certain rights and obligations under the laws of the state. By virtue of their chosen profession they have special rights and are subject to special legal obligations under a set of laws especially created for them. According to the author:

> For this reason, the following pages have been written: to enable the nurse to learn how her professional duties are viewed by the law; how an understanding of a few simple legal principles will help her in the business side of her profession; and how she may conduct herself to avoid becoming involved in litigation as the result of practicing nursing.

The material of the book has been embodied in seven chapters, each of which is a discussion of a fundamental legal subject; such as the legal status of nurses, the legal obligations of nurses, nurses and contracts, nurses and wills, the nurse as a witness, the criminal responsibility of nurses, and property rights in clinical charts, case histories, X-Ray films, pathological specimens, records and forms, ownership, possession, uses. There is a long appendix at the end of the book containing numerous samples of nursing legislation. At the end of each chapter questions and problems are given, which will greatly aid teachers and students in case this volume is to be used as a textbook. The answers to these questions and problems are found at the end of the book.

The authors have presented the material in clear and simple language, using technical terms whenever they are necessary. There are profuse citations of decided cases. Many concrete examples are given in order to make clear the point that the authors want to convey. The case of Lorenza Somera, one time

the head nurse of St. Paul's Hospital of Manila, who was convicted for the death of a patient, is extensively discussed.

The authors are well qualified to write this book, Dr. Carl Scheffel being a lawyer and a physician and Eleanor McGarvah a registered nurse.—G. T. L.

The Plough and the Sword. Labor, Land, and Property in Fascist Italy. By Carl T. Schmidt. New York, Columbia University Press, 1938. 197 pp. Price, $2.50.

This book should be of current interest to students of rural economics. It describes with vivid effects the basic problems of rural Italy and the measures initiated by the government in overcoming threats of decay and misery riding high in the rural sections of that country, and in restoring faith to an apprehensive rural populace. The steps that Italy took in dissipating the problems of poverty, the problems of food of the nation, soil reclamation, agrarian problems between tenants and landlord, and the like, are lessons worthwhile to Philippine economists who are interested in the present agrarian problems of the Philippines. The change from socialism to fascism in Italian rural reforms is a brilliant example of the plasticity of rural populations, and of the success of Italy's attempt to direct the nation's resources, both of land and sea, for the building of a stable government and a moderately economically progressive population.—H. S. S.

The Stag at Ease. A Cookbook being the Culinary Preferences of a Number of Distinguished Male Citizens of the World. Compiled by Marian Squire. Caldwell, Idaho, The Caxton Printers, Ltd., 1938. 164 pp. Price, $2.

The presentation of the recipes by the compiler is unique and unconventional. Unlike the recipe book with which the housewife is usually acquainted, this work is entertaining besides being practical. Each recipe included in it is the favorite of a leading figure of American life who introduces the recipe in a few humorous statements and who, in some instances, gives the recipe itself and the direction in preparing the dish. In this way the reader gets first-hand information on the preparation of a number of the unusually appealing dishes. Where such recipes and directions are not given, the compiler supplies them in a most candid manner. Besides giving us an idea of the favorite dishes of the "famous and not famous, but hungry" men of America, the compiler points to possible substitutions that may be made whenever any of the ingredients is not available with

practically no change in the taste of the dish. The housewife will find the book a very good companion in the kitchen.—C. S.

Street Cleaning Practice. By the Committee on Street Cleaning, American Public Works Association, Chicago. Chicago, The Association, 1938. 407 pp., front., illus. Price, $4.

This book is divided into thirteen chapters and three appendices. As its title suggests, it describes and discusses the different phases of street cleaning practice, the problems met, and their solutions; the different methods and equipment used in various localities in the United States and Europe; planning of the street cleaning system and frequency and more appropriate hours of cleaning the streets; management, records, costs and budgets.

The book is written in very clear language and gives practical suggestions in the practice of street cleaning, which is a very important and necessary activity in a healthy community. It will undoubtedly be a great help to our city engineers, especially to those of the newly created cities in this Commonwealth.—J. G.

Economic Planning and the Tariff. An Essay on Social Philosophy. By James Gerald Smith. Princeton University Press, 1934. 331 pp. Price, $3.

The whole burden of this book is an able analysis and criticism of the plannings during the greater portion of *laissez-faire* in economics. Tariffs, quotas, subsidies, credits, price fixing, production control, and prohibition of alcoholic drinks were tried as instruments for economic and social control, and all resulted in monopolies and special interests. The author concluded that prohibition, "tariffs, monopolies, and price fixing are quite definitely social evils. It does not matter whether the stabilization schemes are instigated by governments, or by private monopolies, their social effects are mischievous." Let us hope that those who are preoccupied with the above questions read this book. Perhaps, it will deprive them of much of their enthusiasm for some of their plans. Perhaps too, they may avoid some of the pitfalls that lurk ahead.

The author analyzes three forms of economic planning, namely: (1) economic planning without profit, (2) economic planning for profit, and (3) economic planning for general welfare by permitting profit.

He calls the first kind of planning socialistic or communistic. It is based on the view that society is a machine which

would run smoothly, if only the evil, that is, individual greed of members of society, is removed. Society is not a machine, and the evil cannot be easily removed, if at all. Society will continue as it has continued for ages to have the same problems, no matter what form of political organization prevails. This is due to the "existence of variabilities in human psychology and behavior, and in nature's behaviour as well." Man is the result of contradictory attributes.

The second type of planning, that is, for profit, has been a dismal failure as shown by historical evidences, particularly by the events since 1929. It is characterized by bargaining and logrolling tactics in legislation which inevitably result in the creation of special interests and big monopolies.

He extolled the third type of planning, that is, planning for the general welfare "permitting profit as an incentive to individual endeavor." But he warned that too often, this planning degenerates into the second type of planning. He is chary about planning altogether. He says:

> The practical operation of social planning results in the pragmatic application of paliatives to solve current impelling social problems. In a democracy the most poorly conceived palliatives prove to be unworkable and are discarded or their enforcement neglected. In a dictatorship they are enforced, usually with unspeakable terrorism and suffering of the masses of the people.

Here is his summary of the ideal conditions on which planning can work. There should be a central authority for social planning, that should have enough of the facts required to make timely judgment. Someone should know well the nature of economic forces. The planning authority should have a broad social outlook, entirely free from personal bias on questions of social conflict, and free from the forces of special interests. Finally, the central authority should have the "power and ability to bring into play promptly and effectively, without cavil of emotion, the actions which its judgment dictates." Otherwise, unfavorable economic forces may go ahead of its plans, and result in chaotic changes. But he failed to advance a working program for the type of planning that he advocates. The nearest to a program is when he asked that all efforts should be bent to the following two directions: "(1) to the education of unbridled individualism towards some measure of self-discipline in the interests of social coöperation: and (2) to the development of adequate means of disciplining recalcitrant individualism which refuses to be self-disciplined."

His real contribution to the subject of planning is his definition of the society in which we live. He said that society is "a product of dynamic psychological individual variabilities in summation,—and social progress is secured by the survival of more desirable variations of individual attributes and social institution." This is a far cry from the mechanistic view of society. If only our plans are candidly reexamined in the light of this view, it is not unlikely that we may some day find our way to the good life.—T. R.

Malaria in the Netherlands. By N. H. Swellengrebel and A. de Buck. Amsterdam, Scheltema & Holkema Ltd., 1938. 267 pp., illus. Price, 10s 6d.

This book is an account of the history and ravages of malaria in the Netherlands, presented in ten chapters. In the opening chapter the authors give a description of the Netherlands as to its geography and topography in relation to the incidence of malaria. They present a comparison of the prevalence of malaria in the past and at present, based on statistics which, unfortunately, are not only incomplete but also inaccurate on account of the lack of adequate knowledge of the disease in the past. The authors give an account of the malaria control work by the use of drugs and of an innovation which they call "sick-clubs." The annual and seasonal variations of malaria and some circumstancial and convincing evidences of its long incubation periods in the Netherlands are brought out. The various species of mosquitos, the preponderance of malaria in that country, caused by *P. vivax*, and the rare or erratic appearance of malignant tertian and other infections caused by other species are discussed in detail. Not only species but also races, with particular reference to the races of *A. maculipennis*, are considered at length. Studies on their cross-breeding and re-cross-breeding which lead to the production of short-winged and long-winged individuals proves very interesting. A discussion on the seasonal reproduction and nutrition of anophelines, which gave rise to gonotropic dissociation and gonotropic concordance and the subsequent variations in anopheline densities due to the occurrence of long and short flights, is a feature of the book that should interest the anopheline specialist.

An extended account of the results of experiments conducted by investigators on malaria infection and the incubation periods of the infective sporozoites is important and should be useful as a check in similar experiments that may be conducted else-

where. The transmission of malaria from mosquito to man and from man to mosquito is very well covered. The authors have devoted a chapter to malaria control. They made instructive comparisons and specific suggestions as to the efficacy of the various control methods advocated. The book also includes studies on malaria induced in patients suffering from general paralysis of the insane.

Physicians and biologists engaged or interested in the study of malaria and its control will find this book a good reference.

—A. E.

RECEIVED

ADDINALL, C. R., compiler. The story of vitamin B_1. Rahway, N. J., Merck & co., inc., 1937. 55 pp., illus.

The chemists' year book 1939. Founded by F. W. Atack. Edited by E. Hope. Timperley and Manchester, England, Sherratt & Hughes, the St. Ann's press. 1257 pp.

DOUTHERTY, JOHN WOOLFE. Pottery made easy. New York, The Bruce publishing co., 1939. 179 pp., front., illus. Price, $2.25.

GANGULEE, N. Health and nutrition in India. With a foreword by Sir John Orr. London, Faber and Faber ltd., 337 pp., illus. Price, 15s /-.

LEWIS, HAROLD MACLEAN. City planning why and how. New York, Longmans, Green and co., 1939. 257 pp., illus. Price, $2.50.

MOLLESON, G. C. Paints and painting. A manual on the composition of paints and specifications for their use. Philadelphia, David McKay company, 1939. 274 pp., front., illus. Price, $2.

ROSS, HAROLD, E. The care and handling of milk. Rev. enl. ed. New York, Orange Judd publishing company, inc., 1939. 417 pp., illus. Price, $4.

SIEGEL, MORRIS. Population, race and eugenics. Hamilton, Ontario, The author, 1939. 206 pp. Price, $3.

WEBSTER, HELEN NOYES. Herbs; how to grow them and how to use them. Boston, Hale, Cushman & Flint, 1939. 156 pp., illus. Price, $1.

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